# Electrical Review

*THE PIONEER ELECTRICAL WEEKLY OF AMERICA*

VOL. XLII. No. 10. NEW YORK, SATURDAY, MARCH 7, 1903. ISSUED WEEKLY

ELECTRICAL REVIEW

*13 to 21 Park Row* *NEW YORK*

BY THE

*ELECTRICAL REVIEW PUBLISHING COMPANY*

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### *TELEGRAPH PROBLEMS.*

Mr. James Swinburne, during his recent inaugural address before the British Institution of Electrical Engineers, stated that practically all telegraph problems have been solved. Doubtless Mr. Swinburne did not have wireless telegraphy in mind at this time; but leaving wireless telegraphy out of the question, have our other systems of telegraphing been perfected? It is true by far the greatest number of messages are still sent by the Morse system, although there are a number of inventors who claim to have devised much improved systems. It is evident that the large telegraph companies at least do not believe that the problem of machine telegraphy has been solved as yet.

Moreover, we do not believe that telegraph line construction has been entirely perfected. Interference from wind and sleet storms can be prevented by putting the wires underground, but the cost for this construction makes it prohibitive, except for comparatively short lines. The line problem will not be completely solved until nothing but the most extraordinary storms or accidents will interfere with our telegraph systems.

### *THE MIDOCEAN DAILY.*

The often-proposed newspaper, to be issued on the ocean liners, has in one instance become a fact. The steamship Etruria, during one of her recent trips, received by wireless telegraphy nine despatches—in all about 120 words—relating to matters of interest in this country and abroad. These were quickly printed and distributed for the information and entertainment of the passengers. This is certainly a most creditable performance, both for the telegraph company and for the ship's officers.

*Desirable Application of Wireless Telegraphy.*

One of the pressing needs at this time is for means of keeping in communication with vessels through the voyage, and we hope that soon this will be the usual, instead of the unusual, condition.

*Objectors to Ship Newspapers Probable.*

No doubt there are a few benighted individuals who will object to this extension of the strenuous life. They have heretofore welcomed a sea trip as a rest and a relief from the constant strain of business life, and they will resent having reports of the doings at home and abroad follow them at every turn of the propeller. But such persons will be few, and doubtless special lines of steamers can be established for their accommodation, advertising "no communication whatever with anybody."

*Desirability of Communication Between Ship and Shore.*

But for the many, in addition to the entertainment afforded by maintaining communication with the land, there is the all-important factor of safety which such communication will bring. In the event of accident, assistance can be called, and much hardship, and probably loss of life, prevented. One or two instances of this would more than compensate for the expense of installing wireless telegraph systems on all vessels.

*Development and Improvement Necessary.*

Of course, further developments and improvements in wireless telegraphy will be necessary before a complete newspaper may be published each morning on shipboard. Interference of two stations must be prevented and reliability ensured. Fortunately recent developments in this method of transmitting intelligence promise to extend the distance of transmission and improve the control very materially.

### *CURRENT CLASSIFICATION IN ELECTROTHERAPEUTICS.*

We have examined with some interest the able report of the Committee on Current Classification and Nomenclature of the American Electrotherapeutic Association, which has recently come to hand, and it was somewhat of a surprise to us to learn that there were fourteen kinds of current. The electrical engineer is generally satisfied with two—alternating and direct. But after an examination of this report it is difficult to criticise the classification here made, and it is to be hoped that this work will be a benefit to electrotherapeutics, though to the electrical engineer it seems somewhat unnecessary. The latter always insists upon knowing in what manner current is furnished, as well as the kind of current, and a description of the apparatus answering the first question necessarily answers the second.

### *TELEPHONES IN RAILWAY WORK.*

But a few years ago the telephone was looked upon by railway men as too unreliable for their use. Now, however, it is becoming very popular with our railroads. A Buffalo paper reports that practically all the railroads passing through that city have their own telephone systems. There are numbers of railroads in the West where the telephone has been used for train despatching with much success. Undoubtedly, a familiarity with the telephone has proved its reliability, and we may look for its more general application in railway work.

### RAILWAY TRAIN LIGHTING.

The need for better and safer systems of train lighting is recognized by railway officials, and doubtless many a manager has turned his eyes longingly toward the electric light, as that seems to offer so many and such great advantages. Electric lighting of railway trains has been used in a number of instances. Indeed, some of the earliest installations of electric lights were on trains, but for some reason this system is still the exception, rather than the rule, on passenger trains.

*Renewed Interest in Electric Lighting of Trains.*

To-day, however, interest in this matter has become active. There are a number of systems to select from, and it seems probable that before long conditions will be so far reversed that the electric light will become the rule, rather than the exception.

*Storage Batteries for Train Lighting.*

Railway trains may be lighted in several ways. Undoubtedly the simplest method is that where a battery of accumulators is placed upon each car. This is charged as often as may be required, and the supply for the lamps and fans is drawn from it as may be necessary. The advantages of such a system are, of course, absence of all moving machinery and all complicated mechanisms. The disadvantages are the varying pressure of the supply and the inconvenience of having to charge the batteries while on the car, or to remove them for this purpose. Variation in voltage can, of course, be taken care of by some method of regulation—either by use of resistance or end-cell regulation. It is probable that this system, which has been tried in a number of cases, would have shown a much better result had storage batteries attained their present state of perfection and had those in charge of them known better how to care for them properly. Nevertheless, in spite of its drawbacks, this system is one not lightly to be cast aside.

*Lighting by Steam-Driven Generator.*

Train lights may be supplied by an engine-driven generator, located either upon the locomotive or in the baggage car. This, of course, is easy to regulate, but there is not much room upon the locomotive, and there is some difficulty in carrying steam in the necessary quantity to an engine in the baggage car. Moreover, it requires more or less constant attention, either taking up some of the time of the trainmen, or requiring an extra man to run it. These small plants are in many cases inefficient, and set up an undesirable vibration throughout the entire train.

*Batteries Necessary.*

If lights are to be provided in cars when detached from one of these trains, batteries must be supplied for each car of sufficient capacity to run the lamps during the time the car stands alone. The use of steam turbines in place of these small engine sets promises to improve this method very materially, doing away with the vibration and giving much better efficiency; but it is possible that other problems will be introduced by the use of the turbine.

*Axle-Driven Generators.*

A system which is possibly attracting the most attention just at this time is that in which a small dynamo is driven from the car axle, and which keeps an accumulator on the car charged. Each car to be lighted is equipped so that each car is thus independent. It charges its batteries while running, drawing upon this for its supply while standing still or running at low speeds. Such a system must, first of all, be entirely automatic, and, second, thoroughly reliable. The generator may be driven in a number of ways—by belts or gears, by friction-wheels, or the armature may be mounted directly upon the car axle. Each of these systems has its defects, and as many of them are in more or less extensive use to-day, experience will prove which is the most reliable.

*Problems Presented with This Method.*

The power required to drive a generator large enough to supply all the lights for a car is small, and the question of using power thus delivered to the car is comparatively easy; but the problem of delivering this in the proper form as to voltage and current is not simple. A passenger car may run at any speed from the moment it starts up to eighty miles per hour or more. A generator directly connected or driven from the axle by a non-variable gear is operating under a condition entirely different from that obtaining in stationary lighting plants. Our work has usually been along the line of constant speed. We have thrown the problem of speed regulation back upon the engine builder, calling for a certain guarantee. Now we must meet a condition radically different. The desirability for constant speed arises from the fact that incandescent lamps are very sensitive to changes in potential, the candle-power varying by something like a fifth power of the voltage, and the simplest way of obtaining a fairly constant voltage is to drive a shunt dynamo at a constant speed.

Much engineering skill has been expended upon engine governing, but even this has not been sufficient in all cases, and it has been necessary to secure additional governing by some electrical device, which usually operates through the field of the generator. The proposition, therefore, of securing a constant potential from a generator driven at such variations in speed as are obtained on a passenger car presents some new problems, solutions for which have been sought in a number of ways.

*Means of Regulating Axle-Driving Systems.*

Regulation may be entirely electrical and take no consideration of the speed of the car, or a variable speed drive may be used in connection with an electrical regulator. Much ingenuity has been expended in devising regulators for this use, and a number of very pretty devices have been developed which give promise of performing their work satisfactorily. In addition to controlling the potential of the circuit to which the lamps are connected, the charging of the battery must not be overlooked, for to obtain satisfactory service from an accumulator it must be charged properly, and also since the voltage varies during discharge the regulator should take care of this.

*Railway Companies Should Aid Inventors.*

As there are a number of systems which promise well, it is to be hoped that the railway companies will aid in this work by thorough trial. No one claims to have solved perfectly the problem, and use only will bring out the defective points.

## THE POSSIBLE DEVELOPMENTS OF ELECTRICAL DRIVING IN FACTORIES DUE TO THE SUPPLY OF ELECTRICITY AT CHEAP RATES BY LARGE POWER COMPANIES.[1]

BY J. S. HIGHFIELD.

It is rather important to bear in mind the intrinsic difference between what have become to be known as power distribution companies and the ordinary electric supply works as operated by companies and local authorities in various towns; it is that the town schemes are started at first to supply light in the central portions of the town, gradually working to the outskirts; to the lighting supply has been added, in all manufacturing towns, and a great number of other towns, a considerable amount of business in supplying electrical energy for driving motors and similar purposes. In the case of the power distribution schemes, on the other hand, the stations, as a rule, are to be placed outside large towns and not necessarily near to them, and the supply is to be given, at any rate at first, to large works, chiefly for power purposes, and in a secondary way small local authorities are to be supplied in bulk for all the usual purposes for which electrical energy is used. This means, in general, that when the power schemes are started on a big scale, the capital outlay on cables is heavy in proportion to the amount of business immediately obtained. It is, therefore, very necessary, at least in a number of instances, that the power companies should be allowed to use overhead wires in place of underground cables, in order that the capital cost of the distributing system may be kept as low as possible. In a great many cases, also, there are no suitable direct routes along which to lay underground cable, as very often a straight run can be obtained across open country or broken ground, where it would not be advisable, even if it were possible, to lay underground cable. Overhead wire feeders can also very readily be increased in capacity, as once the pole line has been erected, it is a very easy matter to erect additional copper.

The following table gives the costs for line construction for the St. Helens (England) corporation plant:

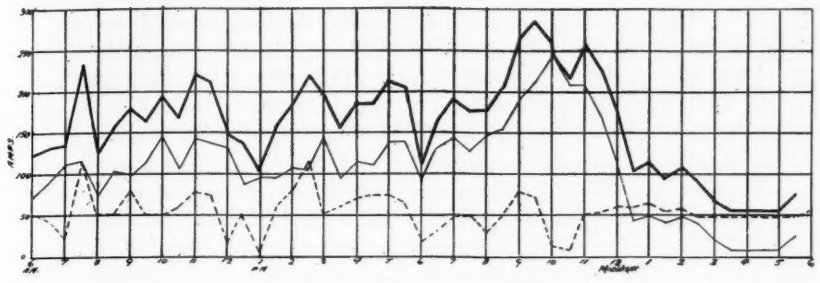


FIG. 1.—LOAD CURVE.

Full heavy line, total; full light line, lighting, etc.; light dotted line, power. Units generated July 17, 1902: lighting, 1,210; power, 440; total, 1,650; load-factor, 43 per cent.

| OVERHEAD WIRE. | Cost per Mile. |
|---|---|
| Poles erected | £150 |
| Insulators | 10 |
| Wire; equivalent section of 0.2 square inch cable | 240 |
| Total cost per mile for two wires | £400 |
| **UNDERGROUND CABLE.** | |
| Two—0.2 square inch paper-insulated lead-covered cables; and troughs laid | £610 |
| Trenching | 90 |
| | £700 |

Note—the above costs are for two 0.2 square inch conductors. The poles are sufficiently strong to carry eight similar conductors, and as each pair of wires is added, it will be seen that the cost for a given capacity of the overhead line becomes increasingly less than the cost of the underground line.

The energy is supplied at 500 volts pressure, direct current, the supply being taken from the same generators which operate the tramways. One pole, the negative of the system, is therefore permanently earthed, and the negative wires are run underneath the positive wires with about eight inches wider spread; they are connected together at intervals of about twenty feet, so that if a positive wire should break it will fall on the earthed negative wire and open the circuit. The Board of Trade has, I understand, since given consent for overhead wires in other places, and therefore I hope that on occasion the power companies may obtain similar permission, if they have not already done so.

The most important point on which the success of the power companies depends is the question of cost of supply, which controls the price which they can afford to charge the consumer, and in this connection it is rather interesting to consider the effect of load-factor on cost. In Mr. Earle's paper, read before this section last year, he assumed the load-factor to be twenty-five per cent, and this figure was very considerably criticised in the discussion. Mr. Charles Merz has been good enough to give me the figure in connection with the Newcastle-upon-Tyne Electric Supply Company; the figure is thirty-three per cent, and I can see no reason why such a figure should not be often obtained, at any rate in manufacturing districts. The effect of load-factor on cost depends on the period over which the load-factor is taken. If the figure is taken over a year, the load-factor so obtained chiefly affects the interest and sinking fund charges per unit; the higher the load-factor, of course, the lower these charges per unit. It also affects, but to a lesser extent, the cost of management and the cost of wages per unit. It has not, however, necessarily a large effect on the coal bill. The load-factor for a much shorter period, the weekly, or even the daily, load-factor is the figure on which depends the cost per unit of coal, stores and repairs. As an instance, I give two curves obtained from

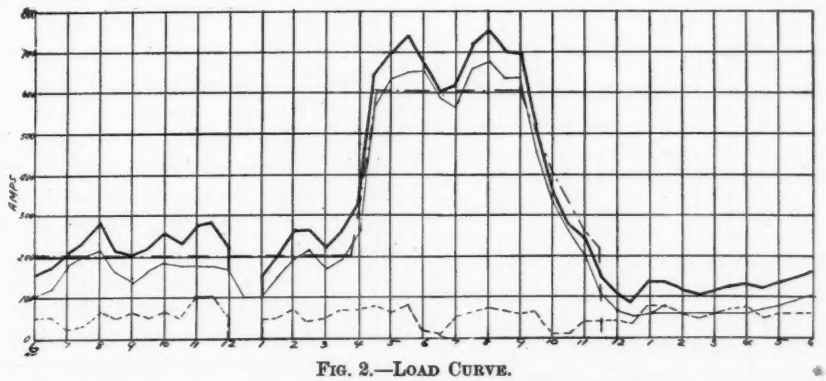


FIG. 2.—LOAD CURVE.

Full heavy line, lighting and power; full light line, lighting; light dotted line, power; broken line, machinery. Units generated December 19, 1902: lighting, 2,830; power, 447; total, 3,277; load-factor, 33 per cent.

[1] Abstract of paper presented at a recent meeting of the Manchester Section of the British Institution of Electrical Engineers.

the St. Helens works; one is in the middle of summer, the other in winter. It will be noted that in Fig. 1 the load-factor is higher than in Fig. 2, although the number of units generated is much less; but the summer curve really shows a more economical load so far as generating costs are concerned; and, as a matter of fact, taking the cost per unit of coal, oil, repairs and stores month by month over the year, I find the difference between summer and winter to be extremely small.

It may be interesting to give the load factors calculated over each month for the St. Helens electric scheme, which, in many ways, carries a similar load to that which one would expect the power supply companies to obtain. The load-factor is calculated on the actual maximum load observed on the feeders and the total units sold each month for lighting, power and traction:

TABLE II.

| 1902. | Load-Factors. |
|---|---|
| January | 20.7 |
| February | 20.1 |
| March | 17.4 |
| April | 17.8 |
| May | 19.2 |
| June | 20.5 |
| July | 21.3 |
| August | 19.3 |
| September | 21.8 |
| October | 22.9 |
| November | 24.5 |
| December | 22.7 |

As the greater part of the load carried by a power company will probably be for power purposes, the daily load-factor as well as the yearly load-factor, will probably be a good deal higher than in the case of an ordinary lighting station, and the difference between summer and winter output will not be great, therefore the cost of generation will be still less than the improved load-factor would indicate to be probable.

Before going on to the special application, it will be well to consider the advantages power companies may have over fairly large sized private plants. It may be taken, I think, for granted that in comparison with small private plants, where the units are not of greater size than 100 or 200 kilowatts, the power companies will, in nearly every case, be able to show greater advantages, partly in the saving of capital, partly in the saving of space, partly in the saving of coal. With regard to larger plants, however, it is to be remembered that in addition to the generating machinery, the power companies have to provide distributing mains, and in a good number of cases, transforming apparatus, which amount to a considerable proportion of the cost of a private generating plant, and when the private plant units are as large as 500 kilowatts, and when the load-factor is good, the cost of production will not be very different from the cost of production by the power companies; that is, so long as steam engines are used. If, however, we consider the use of gas engines in place of steam engines, the Central Supply Company has an immediate advantage over the private plant, because in nearly every case they can operate on a sufficiently large scale, and a sufficiently constant load to enable large gas producers to be used in connection with the recovery of the sulphate of ammonia, as about ninety pounds of sulphate, worth, say, £10 a ton, or eight shillings, can be obtained from every ton of coal; an immense set off can be made against the coal bill. It seems to me, therefore, that these companies should immediately set to work to install at least one or two gas engines, and I have no doubt that in a very short time, if not at once, excellent operation will be obtained at an enormously reduced cost.

I have had reason to go into the matter rather closely and have been surprised to find that the cost of generating by water power is exceedingly small as compared with steam power when the load-factor is high. I have two schemes in my mind —one of which is already working, and where the whole cost of the scheme, including land, comes out at about £50 per kilowatt, and the other scheme, which is not yet carried out, the estimates for which come to about £40 per kilowatt on a scheme of some 18,000 horse-power. It will be seen from these two cases that the capital cost is very similar to what it would have been with a steam plant, and in the first case, the operating costs are extremely small, as they only amount for repairs, wages and stores to 0.02d. per unit. By using gas engines the cost per unit need not be much greater than that supplied by water power.

It is hardly necessary to set out the intrinsic advantages of the electric motor, but I should like to say one word as to cost of repairs. I have now at St. Helens in operation about 500 horse-power of motors, costing, approximately, £2,800. These motors are, in general, hired out to the consumers, the rental amounting to about fifteen per cent on the cost of the motor. The motors are used for all purposes; the largest of them is sixty horse-power, the bulk are five horse-power and less. They are often fixed in dirty places, and, as a rule, are not too well looked after. The total cost of repairs for the year, ending December 31, amounted to only £15. This includes material and wages. The repairs were as follows:

| | |
|---|---|
| Armatures burned out (Two repaired by makers, fault in construction.) | 3 |
| Bearings requiring re-metalling through lack of oil | 3 |

The other repairs consisted in turning commutators and replacing two field coils.

The author then considered the applicability of electric driving to various classes of work and the gain secured by the adoption of this motive power.

In all the discussions which I have read on the question of power schemes, it has generally been admitted that the companies can obtain much, if not all, of the small work, but that they have no chance of superseding the large local steam engine for driving such factories as, for instance, cotton mills, where the load is considerable and is very steady. Many figures have been given showing that it would not be possible for the power companies to supply electrical energy at a price low enough to compete with the direct supply of energy by a local steam engine. There is no doubt, I think, that these figures are correct, but it is possible that the advent of the gas engine will help the electrical power companies to obtain even the loads of this character.

One of the great inducements of taking a supply from outside is the saving in capital expenditure of generating plant; the capital so spent can generally be expended in additional manufacturing plant, and many manufacturers are sure to regard this saving as a great advantage.

The author then discussed the various methods of charging for power and the effect of these upon the station load.

### *Martinique-Guadeloupe Wireless Telegraphy.*

Under date of January 24, 1903, Consul L. H. Aymé, of Guadeloupe, reports:

"Regular daily communication has been established between this colony and Martinique by a system of wireless telegraphy. The station in Guadeloupe is situated near to Gosier lighthouse, and that in Martinique, I am informed, somewhere on the peninsular of La Caravelle, on the east side of that island, so that the air line between the two stations passes entirely over the sea. These stations have been installed by a detachment of army engineers, and only official messages between the governors of the two colonies have thus far been exchanged. The officer in charge informs me that the system used is not the Marconi, but is one devised by the French engineer corps. The spark used is about four inches long, and the power is obtained from a small dynamo driven by an engine using vaporized naphtha. Four wires are used, separate at the top and bottom, forming a long, rectangular cage. The mast is said to be 170 feet high. As all cable communication with Martinique has been interrupted for several months, this is the only means of sending telegraphic messages."

# The One Hundred and Seventy-third Meeting of the American Institute of Electrical Engineers.

*"Railway Train Lighting," the Topic of the Meeting in New York City—The Papers and Discussion.*

THE one hundred and seventy-third meeting of the American Institute of Electrical Engineers was held at 12 West Thirty-first street, New York city, February 27, 1903. It was called to order by President C. F. Scott. The secretary announced that 101 associate members had been elected by the board of directors. He also announced that the annual convention would be held at Niagara Falls the week beginning June 29, and not, as stated in the February announcement, from June 22 to June 26, as hotel accommodations could not be secured for the earlier date. Members and associates who desired to present papers at the convention or suggest topics for discussion were invited to communicate at once with the chairman of the committee.

President Scott called attention to the new arrangements which have been made for the informal dinners. The last two dinners have been very successful as far as accommodations are concerned, but if more members do not attend these meetings the committee will not be able to obtain the rate which is now offered. The reception committee will be very glad to have any suggestions as to improving or making more attractive these informal meetings, and it seems very desirable that they be kept up; but unless a better attendance can be guaranteed, it will be necessary to abandon them.

President Scott then introduced the subject for the evening's discussion—"Railway Train Lighting." He called attention to the great advance which had been made in transportation facilities in the last fiftv years. Great improvements have been made in accommodation, but the lighting of the cars has not kept pace with other advances. It has only been within the last five years that oil has been generally replaced by gas. The idea of using incandescent lights is an old one, and attention was called to the many advantages obtained by the use of this illuminant. The problem of lighting cars is a simple one, as but a small number of lights are required; but the practical problem of supplying energy for these lamps is a most difficult one. The simplest method, and the one first adopted, was the use of storage batteries charged at the end of the run. This method was inconvenient, accumulators were heavy, and the earlv types did not have a long life. In some cases engine-driven generators have been installed in the baggage car, but these did not allow the switching of the cars unless the batteries were placed on each car. There are also other disadvantages, such as vibration. The plant took up a considerable part of the baggage room space, and called for constant attention from the train hands.

A system which is attracting a good deal of attention at this time is that where a generator is driven from the car axle, thus furnishing current for lamps and charging the accumulators for use while the car is idle. The great problem here is that of obtaining a constant potential from a dynamo driven at a varying speed. The energy required for the lights is small, but the appliances are more or less complex and costly. The incandescent lamp in itself is an ideal illuminant for railway trains, but there are many problems to be solved in utilizing this.

President Scott then introduced Mr. Elmer A. Sperry, who read a paper, entitled "Axle Lighting," which had been written in collaboration with Mr. Lamar Lyndon.

Mr. Sperry's paper opened with an interesting review of the advances made in the past decade in car lighting. He called attention to the expression—a "burning question"—by which this study had been designated by a certain author many years ago. The confines of this "burning question," Mr. Sperry remarked, were not limited to illumination, as is illustrated by the periodic firing of solidly steam-heated trains in a state of wreck. Electricity had been proposed from the very first as an efficient means of lighting the car. Not only was it cleaner, but it lent itself readily to decorative effects. Conditions could be brought about in practical lighting which no other system of illumination could create. Electric car lighting in America, he thought, would attain its majority within the present year. Relating the history of this development, the Pennsylvania Railroad Company in August, 1882, electrically equipped car No. 397 with Faure accumulators imported from France for the purpose. This was not only the earliest application of electricity to car lighting in this country, but one of the earliest in the world. This same road promoted the first installation of solid electrically illuminated trains, or series of trains—the Pennsylvania Limited, between New York and Chicago. These equipments were installed in the middle eighties, and are still in continuous service. All are direct-connected sets in the baggage compartment, supplying the lamps, together with batteries under each car.

Meanwhile English railways were active in the same line, their first installations being axle-driven. The London, Brighton & South Coast Railway, in 1883, put on its first axle-driven equipment, which furnished a few lights throughout the entire train. This was quickly followed by the Great Northern and the Midland roads, each of which, in 1886, developed similar equipment, one using the old Brush dynamo, both dynamo and batteries in the "guard's van," similar in this particular to the Brighton & South Coast road. The difficulty of leaving the cars in total darkness on breaking up the train was later obviated in the Midland equipment by distributing the batteries under each car.

Many of these early installations are still in service. The author has recently had the opportunity of inspecting some of the oldest of these equipments, and can testify to their marvelous state of preservation. These old equipments are of extreme value in throwing light upon the unknown factor in ascertaining the cost of operation, namely, deterioration. The experience of these roads allows the establishment of a sinking fund, which, it is believed, can be depended upon to take care of this portion of the cost of operation. In modern service the locomotive represents really a power station of no mean dimensions, developing, as it does, from 1,000 to 1,400 horse-power, and even, at times, a power in excess of this amount. The illumination of the entire train represents not far from one per cent of this, and with a proper combination of generating units and accumulators, considerably less than one per cent.

The perfect system, he thought, required that every car should be entirely independent of every other, and should maintain its lights perfectly after the train is broken up. He cited the many efforts which had been expended to effect this, and of the failures which had

been realized. The system of the future must be one that is thoroughly automatic throughout, especially in view of the modern trend and perfection of electrical and mechanical appliances. The difficulties encountered in the very great variation of speed which the generator must be called upon to stand were pointed out, and the necessity, where this was the case, of providing some mechanical means for dissipating the heat which is generated, not only by the friction devices necessary for taking care of speed, but also arising from electrical phenomena due to the increased rotation of the armature, was called attention to.

He then described a system which has been devised, whereby the excess of current developed is neutralized by an elaborate mechanism which is required to be maintained and operated constantly, needing power whenever the equipment is in service, running or standing. It would seem, from an engineer's standpoint, that it would be better not to call upon the generator for either excessive current requiring dissipation, or upon the car and axle for any more power than is actually required for economically handling the service proposed; and, further, not even upon the generator for more speed of rotation than is absolutely necessary to maintain its loads or potentials constant under the varying conditions.

Another important feature, and one which must always be reckoned with primarily in a car-lighting system, is perfect and constant control. Here a number of factors is encountered which must be so dealt with as to overcome entirely other influences. Among these are the reversal in direction of rotation, the irregular and spasmodic magnitude of the variation in speed, the variation in the charging and the discharging electromotive force of the battery, the jar and tremor of the car or truck on which the apparatus is mounted, and the variation in the load or number of lamps in the circuit. In this system the sensitive moving parts are statically balanced, freeing them from any response to the vibrations, jerk and jar of the car; and the device may be relied upon to regulate not only the potential as delivered to the lighting circuit under varying conditions of load and battery pressure, but also to handle the generator under all possible conditions of speed, variation, reversal and change of load. Furthermore, it has been found that a number of valuable features having an important bearing on this particular subject, and which have not been heretofore introduced as factors, may be employed with perfect success with this system of control and regulation.

The most important of these is a constant-speed generator, the use of which cuts down the torque delivery from the axle, and thus the power absorbed from the axle is in exact accord with the demand for electricity at the time from the generator. When the battery is nearly charged, this current should be largely reduced, and its electromotive force slightly and gradually increased. Any device that will take from a moving train only the power that is at that instant required to be developed, and, as the demand falls off, will release all overplus of power to the train, is certainly desirable, if not necessary, to the success of the coming train-lighting equipment.

Taking the items of deterioration and up-keep, as developed by plants which have been longest in operation, and including interest and all essential features, it can be stated that a candle-power-hour can be produced for about sixty-eight per cent of the cost of compressed gas, and that such gas as now used costs in the neighborhood of forty-six per cent more than an equal illumination in candle-power by the new axle-driven equipment. When calculated in visual units, which includes the deterioration factor, compressed gas is in excess of fifty per cent more expensive than electric illumination, a result upon which it is believed the electrical fraternity should be congratulated, and which should open up a large field for the use of electrical apparatus.

Mr. Sperry was followed by Mr. William L. Bliss's paper, entitled "An Electric Car Lighting System." This paper will be found on another page of this issue.

Mr. Arthur J. Farnsworth then read a paper, entitled "An Axle Light System of Train Lighting." Mr. Farnsworth said, in part:

The problem of electrically lighting steam railroad cars naturally presents greater difficulties than are met with in stationary lighting installations. In addition to furnishing the current and maintaining the pressure within satisfactory limits, the system must assure a reliable and continuous lighting service, and permit of the cars being assigned to any run on their own or foreign roads, have a negligible effect upon the hauling capacity of the locomotive, and compare favorably as to cost of installation and operation with other systems. The author thought that with the axle system alone was there unlimited field of operation. This system, therefore, possessed an inherent advantage that should bring it into universal use, provided the apparatus is constructed to fulfill the severe duty imposed upon it.

The problem of transmitting power is difficult for several reasons. The plan of installing the generator in a manner similar to that in which street car motors are mounted is not to-day considered feasible. Railway mechanical officials have adopted the taper axle almost universally, and will not consider any proposition to turn thereon the necessary straight bearings for the generator suspension, consequently the dynamo must be located independent of the axle, and the drive must provide for a vertical and lateral motion of the latter, and a variable distance between centres. The second difficult problem is the satisfactory regulation of voltage. As the speed of a railway train is constantly changing it is necessary to employ means to counteract the tendency to voltage variation. For this purpose, various forms of differential winding have been used, with some success, and a crude way of accomplishing the result is to depend upon the belt slipping when an abnormal load has been reached. The principle upon which the system he described is based is to control the output of the generator, keeping it constant by varying the resistance in the field circuit to correspond to the train speed. The regulating mechanism which accomplishes this is thrown into action by any variation of the generator current whenever the generator current varies from the normal. It is designed to maintain a constant output of the generator at all train speeds above the "critical speed," or the speed at which it becomes operative, and to maintain a constant voltage at the lamps whether they are being fed from a battery alone, or whether they are connected in multiple, with both the generator and battery at speeds above the "critical speed."

The equipment of this system consists essentially of a generator installed upon the truck of the car, and driven from the axle by means of a belt; a regulator installed in any convenient location in the interior of the car, and a storage battery hung in a suitable box from the car body. The generator is a bipolar, laminated-field, shunt-wound machine, and is installed on suspension irons hung on the truck timbers, pivoted parallel with the axle on adjustable pivot shoes to provide for perfect alignment. A rod and spring maintain the proper tension on the belt.

The generator is provided with a flanged crown pulley, and on the axle is clamped a flat-face, flange, driving pulley, the two being belted together with a rubber belt. The armature shaft carries a worm, operating cam and gear, which throws a switch when the direction of rotation of the armature is reversed. The polarity of the generator is then maintained correct, independent of the direction in which the train is moving.

The regulator contains a solenoid, with spring-balanced plunger to control its operation; the generator field rheostat; a small electric motor, connected by means of worm gear and ratchet mechanism to the rheostat to operate it; an automatic switch or cutout for automatically switching the generator in multiple with the lamps and battery at the critical speed, when the speed is rising, and for cutting it out at the same speed when the speed is falling; and a variable lamp resistance operated by the same mechanism that works the field rheostat.

The discussion opened with a communication from Professor George D. Shepardson, of the University of Minnesota, which was read by Mr. F. C. Bates. This paper gave an historical sketch of train lighting, taking up the various systems severally, and calling attention to some troubles encountered in each.

Professor Henry S. Carhart said that possibly the use of the mercury vapor lamp might help to overcome the difficulty of securing a constant potential with these systems. He understood that the mercury vapor lamp did not require a close regulation of potential.

Mr. Bion J. Arnold called attention to the point that in all cases storage batteries were required, and he thought that Professor Carhart's suggestion of the use of the mercury lamp was rather advanced.

Mr. Lamar Lyndon, of New York, said that some of the papers read seemed to assume that speeds of sixty miles an hour are sufficient. He has been informed by certain railway men that there are times when speeds of eighty-five miles an hour are attained for short stretches. No matter how short these stretches may be, the car lighters must be designed to take care of such excessive speeds. Then, in regard to the battery end, there seems to be a disposition on the part of designers to take it for granted a battery will maintain about two volts. It will not. A battery will require, in order that it shall be properly taken care of, a charging current that will run as high as two and one-half volts. It must be discharged down to 1.8 volts. That is a variation of 0.7 volt, or about 30.5 per cent, taking two volts as the normal. These systems mostly assume that a constant current will flow into the battery, and that with variations of current we have variations of electromotive force at the terminals, which is true; but there are further variations of electromotive force at the terminals due to the changing condition of the battery, and any system based on charging with a constant current or maintaining a constant current in the battery can not maintain the batteries in proper condition. The proper way to charge the battery is that the current shall go in rapidly when the battery is fully discharged and that the current shall gradually be reduced until the battery rises to its maximum voltage, and in order to do that the generator must raise its voltage continuously with the battery, but in such manner as to cause a constant current to flow through. A proper system must contemplate such a continuous rise in the voltage, so that when the battery is fully charged practically no current will flow through it, and those constant-current systems, or systems which assume a constant current, will not maintain the battery in good condition. It must be what is technically known as "boiled" at times to overcharge.

Mr. Farnsworth has stated that about ninety per cent of the systems throughout the world use a belt drive. That is true, because they were originally developed abroad, where the systems are very small and the lighting of a small English or German passenger carriage, and the equipment required, is by no means comparable to the lighting of a Pullman car in this country, and it is a difficult matter to drive such a generator with a belt, or take care of the generator or regulate it by belt slippage. He knows of one system which was originally used in England, and the patent rights for its use in this country were purchased here, and after the system was brought here it had to be totally redesigned for American service, and it took three years to get it in proper shape.

Mr. George W. Blodgett, of Auburndale, Mass., described a system which was tried on the Boston & Albany road between 1887 and 1889. The cars were fitted with two batteries, which at first were charged at one end of the line, and later at each end, power for this purpose being taken from the arc light system, as this was the only available source of supply. He thought that these were the first trains to be lighted entirely by electricity. The system had been discontinued in 1889 because the New York power stations were closed down and current for charging could be secured no longer.

Mr. E. Carl Henry described a system which consisted of a dynamo mounted directly on the car axle by means of a sleeve and copper bushings. The generator was excited by a shunt winding from the battery, and regulated by means of a differential series winding. Two batteries were installed upon each car, and one was discharging through the lamps while the other was being charged. A simple pole-changer is employed, operated by a cross-rod. The system has been used by a western railroad with some success.

Mr. C. W. Hogan, of Harrison, N. J., thought that the regulation of four to five per cent, which had been mentioned during the reading of the papers, was not sufficiently close for lamps having the high efficiency indicated. Central station regulation now was about two per cent, using lamps having a lower efficiency.

Mr. Lockwood stated that a certain railroad has secured a number of steam turbines and will install these for train lighting on its road.

President Scott suggested that many of the difficulties which had been discussed would be avoided when electricity was adopted for the entire work of moving the train and the lighting of the cars.

Mr. J. F. McElroy, of Albany, N. Y., gave an interesting account of his experience with train lighting systems on a Canadian road. One serious problem was the continual movement of the car axle. The temperature variation was another great objection. The use of the belt drive in the severe Canadian weather was not successful, and it was found necessary to change over to gears. He pointed out the long life which storage batteries have when properly cared for.

Mr. Farnsworth stated that the varying potential in car lighting was not as serious a matter as in station lighting, because the low potential used and the short filaments of the lamps had made them less sensitive, and, moreover, the expense of lamp renewals is a small part of the cost of lighting a train.

Mr. Bliss thought that car-lighting engineers would benefit greatly by the experience gained through the use of the electric railway motor. To him it seemed simpler to control the electric circuits than the mechanical drive.

Mr. Sperry pointed out that there are to-day some fast trains which are not lighted electrically. He emphasized the importance of a proper method of charging batteries, and believed that a constant-speed generator offered good advantages for this class of work.

Dr. Reckenzaun and Mr. Sloan also took part in the discussion.

A telegram was received during the meeting, extending an invitation to the authors of the papers to read them at the first meeting of the Philadelphia section, which will be held on Monday, March 9.

## NOTES ON X-LIGHT.

BY WILLIAM ROLLINS.

NOTE CXLIII—ON THE IMPORTANCE OF KNOWING THE POSITION OF THE SOURCE OF X-LIGHT AND OF AUTOMATICALLY RECORDING IT ON THE NEGATIVE WHEN THE PHOTOGRAPH IS TO BE USED IN MEDICOLEGAL CASES.

In the *Boston Medical and Surgical Journal* for March 21, 1901, it was stated that the central ray of the beam of X-light escaping from the tube box and used to illuminate the screen or the photographic plate, should strike these normal to their surfaces; that an instrument should be attached to the tube box or other convenient support, for finding where the central ray struck the screen and automatically recording on the negative the position of the source of X-light. This instrument, to which the name central ray, distance and position finder was given, was invented to aid Dr. F. H. Williams in his classical work on the medical applications of X-light. He had found, in making examinations of the chest with the fluoroscope, it was essential to place the tube in a definite relation to the patient to enable records to be kept which could be compared. This plan of Williams must always remain of fundamental importance. Without it X-light examinations are unscientific, because lacking in precision. Williams method of procedure was to use a plumb line, a cord with a weight at each end. This left no record on the negative. (See Figs. 69 and 70 of the second edition of his work, "Rœntgen Rays in Medicine and Surgery," where the plumb lines are shown above the plate and hanging down on both sides of the patient.) To obtain a record on the negative of the source of X-light, he placed a metal washer on the paper envelope containing the photographic plate, adjusting the tube by means of the plumb lines and a measuring rule until the source of light was under the washer. This method, while sufficiently accurate, if carefully carried out, requires more time than the method of a central ray marker, is most applicable to a patient in a horizontal position, does not show at what angle the central ray strikes the photographic plate, or the distance of the source of X-light. To avoid distortion of the image, and to allow for it, we must both know the angle and the distance. A glance at the two figures mentioned will show that the rule of keeping the central ray normal to the plate was not appreciated, though the departure is slight and would not be worthy of mention except to call renewed attention to the principle. As I still consider my method too simple to be lost sight of, it is described again, with more figures than in my former paper. The method is particularly applicable to medicolegal cases, as false information can readily be given by means of X-light negatives, on which account many judges justly object to such photographs being used as evidence.

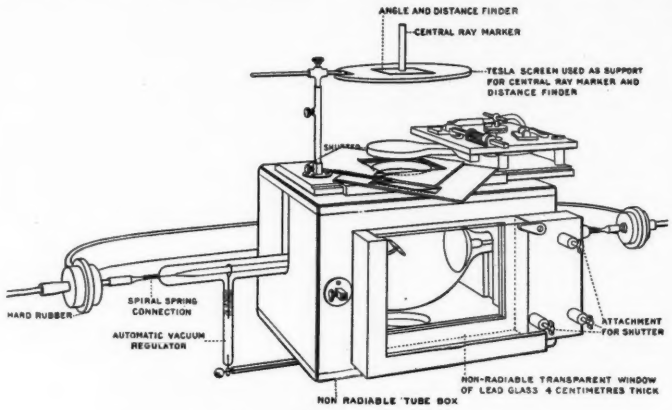

ANGLE AND DISTANCE FINDER
CENTRAL RAY MARKER
TESLA SCREEN USED AS SUPPORT FOR CENTRAL RAY MARKER AND DISTANCE FINDER
SHUTTER
HARD RUBBER
SPIRAL SPRING CONNECTION
AUTOMATIC VACUUM REGULATOR
ATTACHMENT FOR SHUTTER
NON-RADIABLE TRANSPARENT WINDOW OF LEAD GLASS 4 CENTIMETRES THICK
NON RADIABLE TUBE BOX

FIG. 1.

Before X-light negatives can safely be used for such purposes, the principle of automatically recording on the negative the distance and direction of the source of X-light and the angle at which the central ray struck the photographic plate must be adopted. There are many ways of carrying out the idea, but none more simple than those illustrated in the paper mentioned. In the figures accompanying the present paper the instrument is shown attached, as before, to the tube box, for, as my experiments have shown that such a box from which no X-light can escape except the smallest beam that will cover the area to be examined, treated or photographed, is essential, the tube box is the proper place for the attachment of a number of necessary instruments described in these notes. In Figs. 1 and 3 the finder is attached to a thin disc of wood, which, if coated with aluminum foil, becomes a small Tesla screen when put to earth. But, as I have shown in the *Boston Medical and Surgical Journal* for February 7 and 14, 1901, and January 9, 1902, that X-light can not only burn but kill animals after passing through two plates of aluminum, one of which was grounded, the use of a Tesla screen is not so important as was at one time supposed. The finder consists of a metal tube, instead of wire as shown in the figure already mentioned. The tube is attached to the centre of a disc of pine wood. Outside is a square frame of non-radiable metal which has a diameter suitable for the work. In the figures here given, the diameter is four centimetres. As the non-radiable frame is placed at a determined distance from the source of X-light, which is the spot on the target struck by the subatoms of the cathode rush, it is evident that if we know this distance we can tell from the diameter of the shadow on the screen or plate how far they were from the source of X-light, for this starts as a spherical wave which spreads in all directions. For example, if the non-radiable frame is kept at a constant distance of twenty centimetres from the source of X-light, and we find that its image on the screen or negative is eight centimetres in diameter, then we know that the distance of the source of X-light from the screen or negative was forty centimetres. If, as in Fig. 4, the image of the square is free from distortion, and the image of the central ray marker is a circle, then the source of light was directly under that circle and the central ray struck the plate or screen normal to their surface. If, as in Fig. 5, the image of the square is distorted, the central ray did not strike the surface normally. It is obvious that the frame need not be a square. In making examinations with the fluoroscope, the central ray position and distance finder is of particular value

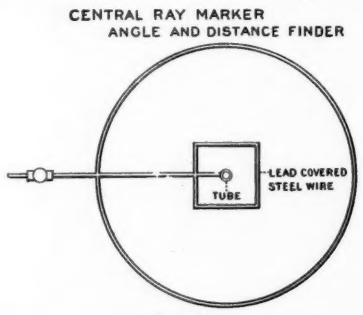



FIG. 2.

also, for showing the position of the source of light, and in avoiding distortion of the shadows of internal organs. Fig. 2 shows another method of mounting the central ray, distance and position finder. Other methods will be figured later. The instrument can be placed in front or below the tube box, when the patient is in front or below the tube. As shown here, the patient is supposed to be in a horizontal position above the tube. The tube box to which the instrument is attached is an improved form of those shown in note xxxvi, August 17, 1898; notes xlviii, xciv, cxii, cxv, cxxxix.

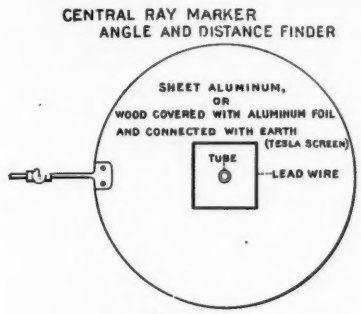



FIG 3.

As after seven years a few realize that X-light is as important to a physician as a microscope, there is good reason for illustrating improved forms of apparatus mentioned in earlier notes, for efficiency and convenience in use now far outweigh considerations of first cost, which have so far been one of the obstacles which experimenters have encountered in their attempts to get suitable apparatus used.

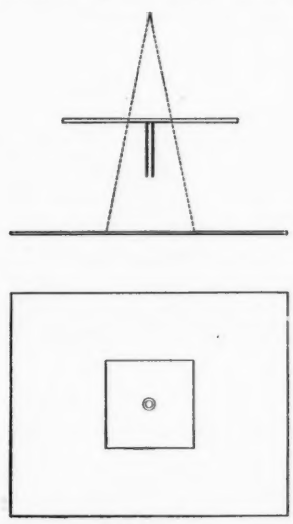


FIG. 4.

This is particularly true of tube boxes, which, being necessary, though even now used by but few, will be described in more elaborate forms, with attachments which are calculated to make X-light examinations more precise and rapid. It is also true of the fluoroscopes, of diaphragms for reducing the diameter of the beam of X-light escaping from the tube box; of shutters for making rapid photographic exposures conveniently, when powerful apparatus shall be the rule instead of the exception. One such shutter was figured in note cxxxix. An improved one is Fig. 1 of this present note, also an adjustable diaphragm, which I have found more convenient than those previously illustrated. It takes the place of the Iris diaphragm, which I applied to X-light examinations in 1896, but have used less than I expected, both on account of its large size, when made of non-radiable material, and because the form of its opening—a circle—while well adapted for shaping the beam of X-light escaping from the tube box, when used for therapeutic work, is not the best shape for examinations with the fluoroscope or for photography, where a rectangular opening is necessary in order to block out all the light except what is needed to cover the plate or screen. If we use a cone of X-light large enough to cover a rectangular screen or plate it is obvious that all around the screen or plate there must be X-light which is of no use and which is injurious, for it illuminates the tissues and blurs the image on the screen or plate. It is, therefore, best to use a shutter having a rectangular opening, and, when doing therapeutic work, to insert in this opening or in front of it an Iris diaphragm, which may then be quite small, as the area to be covered in therapeutic applications is usually rather limited. These matters will, however, be considered in more detail when describing shutters and diaphragms.

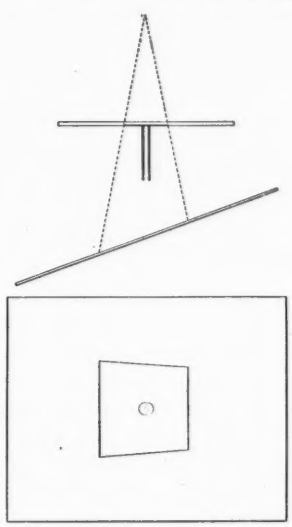


FIG. 5.

### *Proceedings of the Engineers' Society of Western Pennsylvania.*

The December issue of the proceedings of the Engineers' Society of Western Pennsylvania contains several important articles upon the microscopic study of iron and steel. Professor Albert Sauveur's paper upon "The Use of the Microscope in the Determination of the Properties of Steel," gives a detailed account of his work along this line. This paper is fully illustrated with plates giving a clear idea of the appearance of the changes through which steel passes when subjected to various treatments. Mr. W. J. Beck has a paper upon "The Preparation of Samples for Microscopic Analysis as Followed by the Westinghouse Electric and Manufacturing Company." This gives careful directions for preparing samples. Mr. R. G. Beker has five tables showing the steel products, iron ore, pig iron and coke and coal in the United States since 1885. This issue also contains in addition to the discussion on the above papers, a translation of an article by F. Osmond on the "General Method for the Micrographic Analysis of Steel," as this contains much information relative to the subject under discussion.

### *Gold Extraction by the Cyanide Process.*

The time required for the complete extraction of gold from its ores by the cyanide process depends upon many conditions. It may be stated, however, that the tendency is to lengthen the time of treatment due chiefly to the lowering of the strengths of the solutions used. In 1890 the McArthur-Forrest Company, of Glasgow, gave the time as about six hours. A year or two later the time most frequently mentioned was twenty-four to thirty-six hours. In 1895 forty-eight hours was a common time, and to-day from 72 to 120 hours appears to be the usual length of time. The time required depends upon the size of the gold particles, the permeability of the ore, the strength of the solution. The rule is to treat the ore long enough to get all possible value out. The ore in the vats consumes no power, and by giving a longer treatment all that is needed are a few more vats and a larger building to keep them in. The following are a few of the times required at different mills: Dexter-Tuscarora, Nevada, 120 hours; Mercur, Utah, old mill, 60 hours; Bodie, California, 102 hours; South Africa, five to ten days.

### *The National Convention on Municipal Ownership and Public Franchises.*

The National Convention on Municipal Ownership and Public Franchises, held under the auspices of the New York Reform Club committee on city affairs, in the assembly room of the club, 233 Fifth avenue, New York city, February 25, 26 and 27, opened on Wednesday with a large attendance of delegates, who indulged in spirited discussions of the papers presented. The address of welcome was scheduled to be presented by Mayor Low, but as he was in Albany his place was taken by John G. Agar, the chairman. During his remarks, Mr. Agar said that the meeting was for a study of the conditions in American cities, relating to public ownership questions as understood by thoughtful citizens.

The first paper, on "Recent History of Municipal Ownership in the United States," which had been prepared under the direction of the late Dean Charles Waldo Haskins, of New York University, was read. This was followed by the reading of a paper on "Political Influence of Corporations Holding Public Franchises," by Clinton Rogers Woodruff, of Philadelphia, secretary of the National Municipal League.

A short address was made by Mayor Urquhart, of Toronto, Canada, dealing with the advantages which his city had secured under the operation of the water plants by the municipal authorities. The municipal authorities of Toronto had also bought the street railways and leased them, and the finances of the city had been improved as a result.

Robert P. Porter, director of the Eleventh Census, not being able to attend the convention, sent a paper which was principally devoted to an attack upon the municipal ownership experiment in Great Britain. Robert Donald, editor of the *Municipal Journal* of London, contributed a paper which was a reply to Mr. Porter's, upholding public ownership and citing Glasgow, Scotland, as an example of financial success in such a venture. He also cited the one-cent fare on the Metropolitan Underground Railway, of London.

Dr. R. M. Maltbie, editor of *Municipal Affairs,* supported Mr. Donald's views.

Many interesting facts about German experiments with municipal ownership were explained in a paper sent by Burgermeister Edward T. Hein, of Berlin.

The afternoon session was devoted to transportation. This took up the reading of a paper by C. R. Bellamy, general manager of the municipal street railways of Liverpool, England, who came to New York especially to attend this convention and read a paper in favor of municipal ownership of street railways. Mr. Charles T. Yerkes, of London and New York, contributed a paper against this, which was read by the secretary of the convention. These papers excited a prolonged discussion, which was followed by the reading of another paper by Mr. Louis D. Brandeis, of Boston, Mass., who told of Massachusetts's experience with street railways.

The Thursday morning session was devoted to gas and electric lighting, and was opened by a paper by Victor Rosewater, editor of the Omaha *Daily Bee,* which was read by the secretary. Mr. Rosewater's argument was for the ownership of electric lighting plants by the municipalities. James Blake Cahoon, secretary of the National Electric Light Association, opposed Mr. Rosewater's views, and these papers were ably discussed by the city electrician of Chicago, Edward B. Elliott; A. L. Pierce, superintendent of the electrical works in Wallingford, Ct.; Frederick F. Ingram, commissioner of electric lighting, Detroit, Mich., and Joseph E. Lockwood, president of the Michigan Electric Company, of Detroit.

A paper prepared by Mr. Alton D. Adams, in favor of municipal ownership of gas lighting plants, was read by the secretary, a paper on the same subject being contributed by Walter R. Allen, of Boston.

At the afternoon convention the Hon. John De Witt Warner, president of the Art Commission of New York city, contributed a paper on "Municipal Operation Necessary to Coordination of Public Services." He spoke of the tendency of immense combinations to control public utilities under a single company or syndicate, citing several examples.

In discussing the city ownership of the water supply, Thomas Fulton, secretary of the Citizens' Union, mentioned some of the experiences he had met with in his investigations of municipal affairs in this city, and of the great waste of public money that had been revealed to him.

A paper on "City Ownership of the Water Supply" was presented by Mr. William R. Hill, ex-president of the American Waterworks Association. This subject was ably discussed by Commissioner Robert Grier Monroe, of New York city, in addition to the remarks made by Mr. Fulton.

The most interesting discussion of the session took place upon the subject of municipal control of telephone service. The introductory address on this subject was made by Mr. Union N. Bethell, first vice-president and general manager of the New York Telephone Company, on the topic, "The Superiority of Corporation Ownership of Telephones." This paper was replied to by Professor Frank Parsons, of the Boston Law School, who favored municipal ownership. Professor Parsons was followed by A. R. Bennett's paper on "European Experience of Public Ownership of Telephones," this being read by the secretary.

On Friday morning the session was opened by a paper by Dr. Charlton T. Lewis on "How Should Public Service Corporations Be Controlled." This was followed by a paper by Allen Ripley Foote, editor of *Public Policy* on "Regulation and Taxation of Public Service Corporations." Other speakers were John R. Commons, secretary of the taxation committee of the National Civic Federation; Robert V. Ingersoll, George H. Shibley and Eltweed Pomeroy. The last-named gentleman spoke on the subject of the referendum and the initiative in relation to municipal ownership. The closing paper was on the "Taxation of Franchises," this being presented by Professor R. A. Seligman. This was discussed at length, and a number of pertinent facts with relation to the economic conditions pointed out by Wheeler H. Peckham, Senator John Ford and John De Witt Warner.

### *Report of the Committee on Current Classification and Nomenclature.*

The report of the Committee on Current Classification and Nomenclature, read before the American Electrotherapeutic Association, September 4, 1902, has been published in pamphlet form and issued by the secretary, Mr. W. J. Jenks. This committee was chosen at the meeting of the above society in September, 1901, and is composed of Messrs. Elihu Thomson, Samuel Sheldon and William J. Jenks, all well-known members of the American Institute of Electrical Engineers.

Chapter I takes up the classification of currents as used in electrotherapeutics, with respect to their prime electrical source. In chapter II is taken up the classification of currents with respect to secondary electrical generating or modifying apparatus, and chapter III takes up the classification of currents with respect to direction of flow, variation in strength, and time. The different features of the phenomena encountered are illustrated by simple diagrams, and an effort is evident of the desire to formulate a comprehensive indication of the study in as few words as possible.

# The Bournemouth Combined Conduit and Trolley Tramway System.

*By Our Special Correspondent.*

ALTHOUGH the system is by no means a large one, the combined trolley and conduit trams in Bournemouth, a popular south of England watering-place, have many points of novelty and interest, not the least being the fact that the whole of the work has been carried out by the English house of an American firm.

The whole of the undertaking is the property of the local authority, and dealing first of all briefly with the generating station, which supplies electrical energy for both lighting and traction purposes, it is to be noted that there are at present four Belliss engines, direct-connected to British Thomson-Houston dynamos, each set running at 260 revolutions per minute and having a capacity of 292 kilowatts. The engines are of the three-crank, triple-expansion type, governing being done on the throttle, while the dynamos are of the

SHOWING THE CONSTRUCTION OF THE SIDE SLOT.

British Thomson-Houston Company's usual eight-pole traction type. There is in addition a motor-generator having a capacity of seventy-seven kilowatts, and a speed of 550 revolutions per minute. Both sides of this machine are four polar. The boilers are of the ordinary Lancashire type.

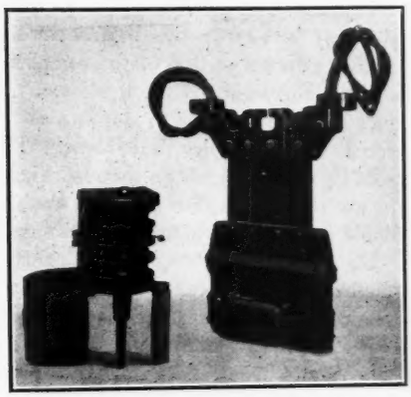
A certain amount of interest naturally centres around the switchboard, which has to supply three more or less independent sources, *viz.*, the public lighting, trolley lines and conduit lines. The board is built on a steel frame, which supports the slate slabs of which it is composed by iron brackets which project from the frame in a way which ensures the back being in one place. The lighting board is apart from the one mentioned above, although connected to it.

The combination of the trolley and conduit systems has by no means been

THE FINISHED ROAD-BED.

adopted by the Bournemouth Corporation as a pretty experiment, but has been forced upon them by the nature of the town. In fact, some of the streets are so narrow that the return journey has to be made by another street. The side slot system has been adopted, under the advice of the consulting engineers, and Messrs. J. G. White & Company, the contractors, who are also at present constructing a centre slot system for the London County Council, are to be congratulated upon having secured the orders for the only two instances of their kind in Great Britain.

The lines are of three-foot six-inch gauge and the side slot is one inch in diameter. At the points of joining the trolley portion of the system, the slot works its way to the centre of the track, where it narrows down to three-quarters of an inch in diameter. The depth of the conduit is two feet six inches and the extreme width fourteen and one-half inches. At the junction of the two modes of traction, plough pits have been con-



THE CONSTRUCTION OF THE PLOUGH.

structed for disconnecting the plough, which is raised up by means of the mechanism seen in one of the views, and

MECHANISM FOR LIFTING PLOUGH FROM THE CONDUIT.

making the connection through the overhead trolley. At present seven such pits have been put in. It is anticipated that when the men in the cars have got used to the arrangements, the change from con-

duit to trolley, or *vice versa,* will be made in from ten to twenty seconds.

The plough, a view of which is given, is precisely similar to that which will be ultimately employed on the South London lines. The head is of cast steel, and the bottom of wood, which carries the rubbing contacts, which, it will be seen, are kept in position by springs. Beside the plough will be seen the change-over switch, the handle of which, not seen in the picture, has a twelve-inch movement for connecting the trolley and rail on the one hand, and the two conductors in the conduit on the other. This is placed under one of the seats on the car. The view of the truck shows the plough lowered, another shows the junction of the trolley and conduit lines (the overhead wire may be seen in the distance). Yet another shows a section of the completed conduit, and there is also a view of the splendid Christchurch road, which is served by the trolley line alone. The second pole, looking down the road, shows the arc lamp pillar, but the lamp was not in place when the photograph was taken.

The British Westinghouse Company supplied the electrical equipment of the tram-cars. Each car carries two Westinghouse tramway motors and two of the same firm's controllers, of the series parallel type.

The conductors in the conduit are carried at a distance of fourteen and three-quarters inches from the top of the slots. The insulator, clip fastening and bonds are in principle similar to that which has been adopted on all conduit lines hitherto. The yokes which carry the slotted rail each weighs 200 pounds, which are placed at intervals of three feet nine inches.

A combination such as has been constructed at Bournemouth has never been attempted in Great Britain before, and in the event of its proving a success, as there seems every reason to anticipate, it will no doubt bring in its train many local authorities whose members have an antithesis to the overhead trolley system in busy thoroughfares, and in Great Britain these are not a few. A. WEBSTER.

London, February 28.

## *Report of the New York State Electrical Laboratory Commission.*

The report of the New York state electrical laboratory commission has been received. This contains the recommendations of the committee, and plans and estimates for the laboratory. A large number of replies to the circular letter sent out by the committee are given, which show a generally favorable attitude toward the establishment of the laboratory.

## *Electricity and Air Compressors.*

Mr. William Thompson, in a paper recently presented before the Canadian Mining Institute, reported the conditions and results of thirty days' tests of a steam-driven air-compression plant owned by the Le Roi Mining Company, Limited, and the electrically operated plant of the Rossland Great Western Mines, Limited. Both are located at Rossland, B. C.

TABLE I.

Work Performed by Steam Plant—Average indicated horse-power at steam cylinders of the combined machines, 730; cubic feet of free air compressed per minute from atmospheric pressure to 95 pounds per square inch, 5,432; cubic feet of free air compressed per hour, 325,920; average horse-power required at steam cylinders to compress 100 cubic feet of air per minute to gauge pressure, 13.4; pounds of coal consumed during test, 1,038,000; pounds of coal consumed per day of twenty-four hours, 36,400; average pounds of coal consumed per horse-power per hour during test, 1.9.

TABLE II.

Work Performed by Electric Plant—Average horse-power registered at switchboard, 540; cubic feet of free air compressed per minute from atmospheric pressure to 95 pounds gauge pressure, 3,319; cubic feet of free air compressed per hour, 199,140; average horse-power required at motor to compress 100 cubic feet of free air per minute to 95 pounds gauge pressure, 16.3.

TABLE III.

Cost of Operating Steam Plant—Total cost of fuel consumed during test, $2,880.45; total cost of wages for employés, $710; total cost of oil, waste, etc., $147.30; total cost for thirty days, exclusive of maintenance and depreciation, $3,737.75. Cost per horse-power per month for fuel, $3.96; cost per horse-power per month for oil, etc., $0.20; cost per horse-power per month for wages, $0.97; total, $5.15. Cost per horse-power per annum, $61.56; cost for each 100,000 cubic feet of free air compressed, $1.56.

TABLE IV.

Cost of Operating Electric Plant—Cost of current for thirty days, $1,744.26; cost of employés' wages, $270; cost of oils, waste, etc., $73; total cost for thirty days, exclusive of maintenance and depreciation, $2,087.86. Average cost per horse-power per month, $3.87; average cost per horse-power per annum, $46.44; cost for each 100,000 cubic feet of air compressed, $1.46.

TABLE V.

Showing comparative results between the two types of compressors, based on each 100,000 cubic feet of air compressed from atmospheric pressure to 95 pounds receiver pressure:

Cost for each 100,000 cubic feet of free air compressed by steam plant (see table III), $1.56; cost for each 100,000 cubic feet of free air compressed by electric plant (see table IV), $1.46; result, percentage of saving by electricity over steam, 6.4.

## *The Chicago Electrical Association.*

While the standard of the papers read before the Chicago Electrical Association has been very well maintained, and the attendance and discussion have been all that the executive committee could desire, it has not yet offered the opportunity for informal contact, of which the members are desirous. To make up for this, three of the coming meetings of the association are to be semi-social events, with an informal dinner preceding the paper of the evening.

The spring dates, as just announced, are as follows:

March 6—"Engineering Activity in the Central West," by S. G. McMeen, engineering department, Western Electric Company. This is to be preceded by a dinner, at six o'clock, at the Albion Café, Pullman Building.

March 20—"Telephone Service," by S. G. Larned, general superintendent of the Chicago Telephone Company. This meeting will be held at 1736 Monadnock Building, and will be of a purely technical nature.

April 3—"Effects Produced by Grounding the Neutral on an Alternating-Current System," by G. M. Eastman, of the Chicago Edison Company. This meeting will be preceded by a dinner at the Albion Café, Pullman Building.

Another meeting will be held on April 17, at 1736 Monadnock Building, the topic and speaker to be announced later.

## *February Announcement of the American Institute of Electrical Engineers.*

The February announcement of the American Institute of Electrical Engineers has been received. This shows that the membership has now reached a total of 2,800. The announcement also gives the reports of nearly twenty local chapters, indicating the success with which this movement has been attended. Notice is given that members of the Institute may now secure *Science Abstracts* at a considerably reduced figure. This publication is now issued in two sections, section A treating with the pure sciences, physics, chemical physics, etc., and section B with applied sciences, or engineering. The price to members of the Institute is $3.50 for either section separately, or $5 for the two.

# INDUSTRIAL ELECTROCHEMISTRY AND ELECTROMETALLURGY—VIII.

## *Notes on Progress in Europe and America.*

BY JOHN B. C. KERSHAW.

### *The Efficiency of Ozonizers.*

Now that the use of ozonized air for water purification and sterilization is again receiving considerable attention the question of current and energy efficiency, in ozonizers of various design, becomes of importance. Numerous laboratory investigations have been carried out in recent years relating to the conditions which must be observed in order to obtain a maximum yield in the ozonizer. Thus Chassy, using a Berthelot tube type of ozonizer, found that the efficiency tends toward a limit fixed by the temperature, and that to obtain a concentration of seven per cent, demanded ninety times as much energy as to obtain one of one-half per cent (*Comptes Rendus,* 1901, p. 789). Ladenburg has also examined the conditions necessary for obtaining a maximum yield with the Berthelot ozonizer, and found that the best results were obtained when using a current of two to two and one-half amperes in the primary of a twenty-centimetre diameter coil, with a temperature of seventeen to twenty degrees centigrade. When using oxygen in place of air for supplying the ozonizer, a ten per cent conversion into ozone was effected. (Berichte d. deustche Chemische Gesellschaft, 1901; p. 3849.) Now that compressed oxygen is comparatively a cheap raw material, this substitution might be found to pay.

A rather curious fact in relation to ozone formation by the silent discharge has been brought to light by an investigator who records his observations in the Annalen d. Physik, No. 12, 1902. According to D'Albe's abstract of this paper in the *Electrician* (London), December 19, 1902, the author of the paper has found that decomposition of the ozone already formed always accompanies the silent discharge, and the rate of such decomposition varies according to the direction of the discharge. It is found to be greatest at the positive pole. Whether any practical application of this discovery can be made remains to be seen; but possibly those ozonizers, which at present yield the best results, have been unconsciously designed to suppress as far as possible this secondary action of the current at the positive pole.

### *Carbon Disulphide.*

The manufacture of carbon disulphide by the Taylor process fully described in the ELECTRICAL REVIEW of February, 1902, is an electrometallurgical industry which in some respects is open to the same criticism as that made with reference to the barium hydrate manufacture by the Bradley and Jacobs process, at Niagara. (See chapter VII.) The ordinary process used for the manufacture of carbon disulphide is simple, and consists in passing the vapor of sulphur over red hot carbon. The temperature required is comparatively low, and can easily be attained by ordinary methods of heating. The difficulties of the manufacture are chiefly those arising from the low boiling point and highly inflammable nature of the product. Carbon disulphide boils at forty-seven degrees centigrade, and when mixed with air the vapor forms an explosive compound. The electrometallurgical method of production as regards cost of the actual heating agent, is therefore likely in most localities to compare unfavorably with the older method, and the advantages on the side of the Taylor process must be sought in the lessened risks from fire and explosion, which the adoption of electricity as the heating agent will produce. The electrical part of the plant will, however, require careful designing to exclude all chance of short-circuits.

It is evident that with such a highly volatile and inflammable product as carbon disulphide it is desirable to exclude all open fires or flames from the factory where it is made. With the older process of manufacture this is impossible. With the Taylor process, in which electricity supplants coal or gas firing, this banishment of one real cause of danger is achieved. The Taylor and similar processes for the manufacture of carbon disulphide, are therefore likely to extend where electric power is cheap. At Penn Yan, N. Y., 660 kilowatts are reported to be utilized in this manufacture, and furnaces of the Taylor design, producing 8,000 pounds of the product per twenty-four hours, are said to be in operation. As the product is widely used in the rubber and oil industries, it is possible that in time the manufacture of carbon disulphide by aid of electric heat may become a very flourishing branch of the electrometallurgical industry.

### *New Electrochemical Publications.*

The literature of electrochemistry and electrometallurgy increases every year, and the student in these new branches of science and industry has now some difficulty in selecting the most suitable and useful text-books or handbooks, as guides to the theory and application of electricity in relation to chemical and metallurgical processes.

When one recalls the fact that twelve years ago the most useful and widely read book was Gore's "Electrolytic Separation of Metals," and that no paper or journal dealing exclusively with electrochemistry or electrometallurgy existed, the progress of the last twelve years and the number of publications now devoted to these subjects are striking and surprising. The electrician or chemist interested in the practical side of electrochemistry and electrometallurgy, finds an increasing difficultv in keeping himself informed as to the progress in all countries. To meet this difficulty and to provide a useful current index to papers and articles dealing with the industrial applications of electrochemistry and electrometallurgy, Dr. Franz Peters, of Berlin, has commenced the publication of a monthly index, entitled *Elektrochemische Technik.* This not only provides an alphabetically arranged subject index to all the recent papers and articles on industrial electrochemistry and electrometallurgy; but also supplies abstracts of the facts and figures contained in the more important contributions of this kind.

At present Dr. Peters appears to confine himself to the German, English and French papers and journals, but I have no doubt that if the editors of American technical journals will support him in his praiseworthy effort, he will extend the scope and usefulness of his monthly subject index.

Dr. Peter's address is Platanen Allee 7, West End, Berlin; and the cost of the index is only five marks per annum to subscribers residing abroad.

A more important enterprise is the publication, by the well-known German firm, W. Knapp, of Halle, of a series of "Monographien uber Angewandte Elektrochemie," the series being edited by Dr. V. Engelhardt, of Vienna, and each work being written by an expert in the manufacture or industry with which it deals. Three of these volumes, which are exceptionally well printed and illustrated, are already published, namely: I—"Die Electrolyse des Wassers," by Dr. Engelhardt, price, five marks; II—"Aluminum," by A. Minet, price, six marks; III—"Die Ausbildung des Elektrochemikers," by Professor Lorenz. Other volumes of the series will appear at quarterly intervals, and, when completed, these volumes will form the most complete and, one would judge, reliable reference work on the development and progress of the electrochemical and electrometallurgical industries in all countries.

## AN ELECTRIC CAR LIGHTING SYSTEM.[1]

BY W. L. BLISS.

A description of an axle-driven electric car lighting system in which the generator is located on the truck frame, the armature being rotated by means of a single reduction gearing. Explanation of the mechanical construction of the generating apparatus and the method of controlling the electrical energy under all conditions of railway service.

In presenting this paper, the author assumes that the members of the Institute are generally familiar with the subject of train lighting from the axle, and that no allusion to the previous state of the art, or the many failures and disappointments along this line of engineering is necessary or desirable. The admirable papers of Brown, Bauer, Blodgett and others have familiarized the members of the Institute with the work that has been done in the past and the degree of success that has been attained. It is with this thought in mind that the author will present for your consideration a modern method of train lighting from the axle that is reliable in its operation, and which has passed beyond the experimental to the commercial stage, and is becoming standard railway equipment.

This system consists essentially of the following elements:

First—A dynamo electric machine or generator located on the car, or, as is the common practice in this country, directly on the truck frame, and so arranged that its armature is caused to rotate by means of a mechanical connection with the axle.

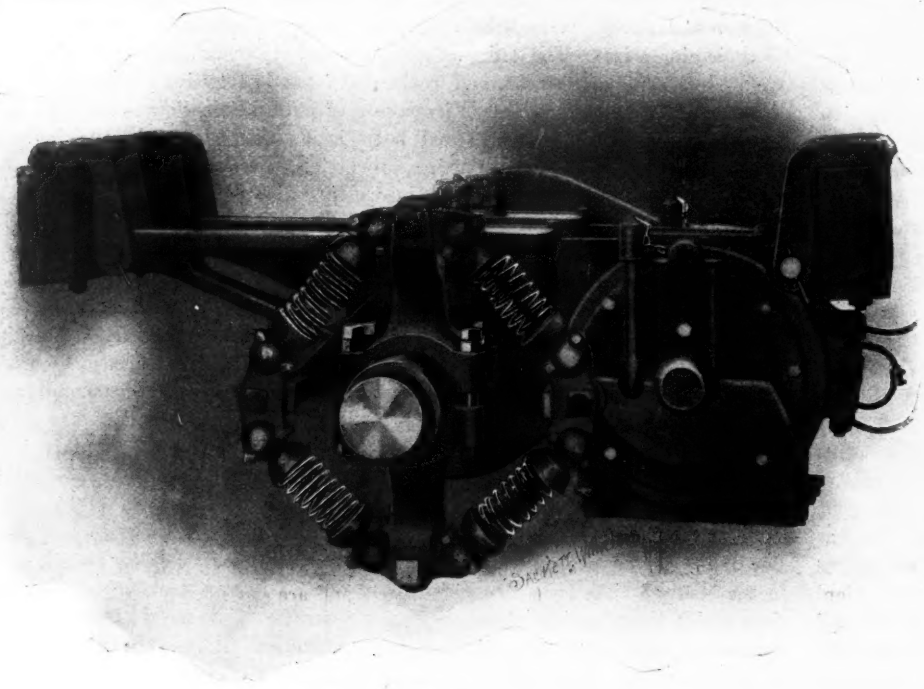


FIG. 1.

Second—Translating devices within the car consisting in general of incandescent lamps and fan motors, and which utilize the electrical energy developed in the generator.

Third—A storage battery carried on the car, whose special function is to supply the electrical energy necessary to operate the lamps whenever the armature of the generator revolves at a speed too low to render the same operative, or when the armature ceases to rotate, which condition is obviously attained when the car is at rest.

Fourth — Auxiliary automatic apparatus, which, acting in conjunction with the above, will render the operation of the entire system automatic, safe, and reliable.

### THE PROBLEM.

In attempting to attain the results indicated above, a multitude of difficulties present themselves which may be classified into two primary groups: (*a*) those which are purely mechanical and are concerned with the motive power, and which must be overcome before the generator can be operated successfully; and (*b*) those which appertain to the control of the electrical energy after it is developed and which are principally of an electrical nature, although involving no small appli-

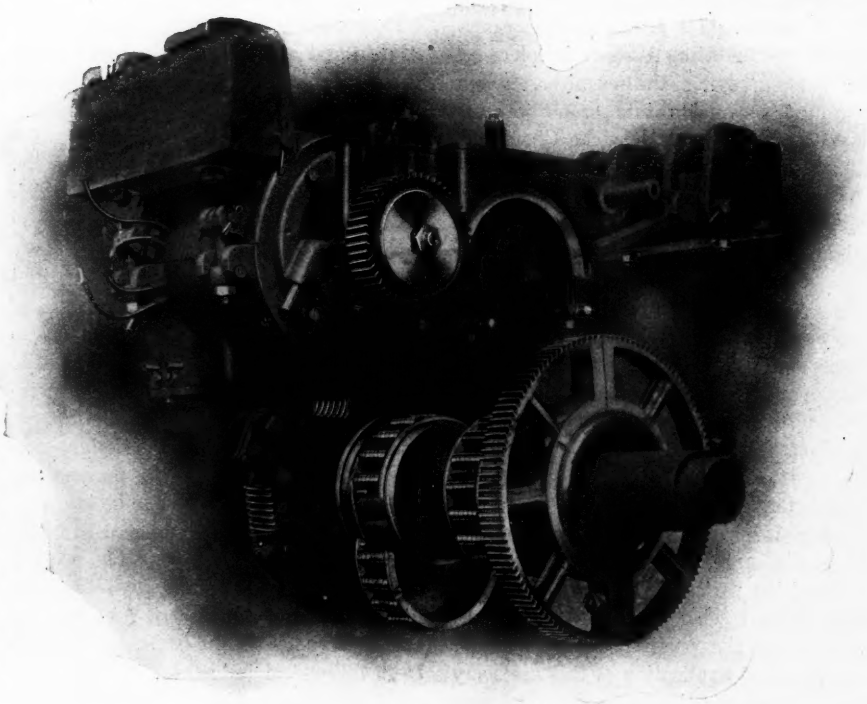


FIG. 2.

[1] A paper presented at the 173d meeting of the American Institute of Electrical Engineers, New York, February 27, 1903.

cation of mechanics. The difficulties under group (*a*) arise from the peculiar character of the source of power, the location of the generator and the conditions under which the latter must operate.

As the generator in this system is located on the truck frame there must first be provided a machine mounting and axle connection which shall withstand the injury and abuse coincident with the most exposed position in which a piece of electrical apparatus can be placed. Secondly, there must be provided an axle connection which shall not necessitate any change in the manufacture of standard railway axles. Such axles are rough, tapered and out of true, and no connection which contemplates the use of keys, set-screws, etc., or which requires turning, trueing or machining the axle in any way will be permitted by railway officials. The reasons for this are obvious and require no further comment. (See Fig. 1.)

METHOD OF DRIVING.

In this system the generator and driving mechanism are modeled somewhat on the lines of the modern street railway motor, such modifications and additions being introduced as to adapt the apparatus to the special work in hand. A single reduction, gear-driven generator has been adopted, but, unlike the ordinary street-car motor, the entire weight of the machine is carried on the truck frame, it not being possible to journal on the axle, for the latter, as previously indicated, is not, nor will present railway practice permit it to be, suitably prepared

Instead of journaling the axle in bearings attached to the frame of generator, two large brackets are carried out from the frame or casing of the generator and are adapted to receive and support a hollow shaft, which runs on roller bearings, and upon which the split gear which meshes with the armature pinion is mounted. The hollow shaft, as well as the brackets, is divided longitudinally in order to permit assembling on the car truck. The car axle extends through the hollow shaft, a clearance of nearly two inches all around the axle, and between it and the hollow shaft being provided. (See Fig. 2.)

This clearance permits the axle to take all manner of motions and positions (within certain limits), with reference to the hollow shaft. Only one component of the axle's motion is transmitted to the hollow shaft, this component being that of rotation. All other motions, the horizontal, vertical and end shake, being provided for in a positive though flexible connection between the axle and the hollow shaft. This consists of a two-armed dog clamped on by four bolts securely upon the axle, and four specially constructed driving-springs which are attached by means of ball-and-socket fastenings to the two ends of the dog, and to the two arms of the hollow shaft.

The driving-springs are of the "keg" or helical type, wound with tapered ends,

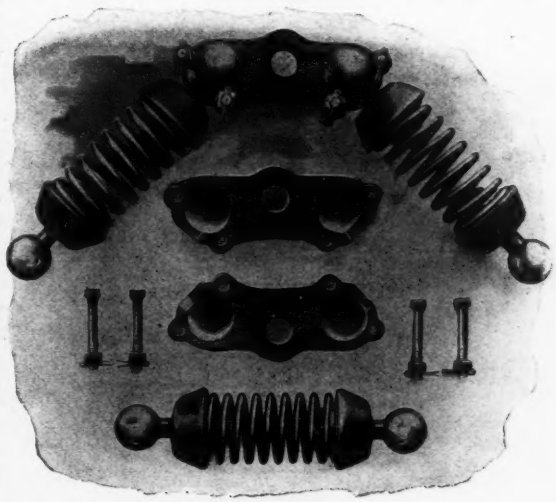


FIG. 3.

and are mounted in shallow cups, through which are screwed ball-ended bolts which form a part of the ball-and-socket fastening referred to. Inside the springs the bolts are threaded and provided with nuts and conical washers which fit the inside of the tapered ends of the springs. The nuts are set up with a spanner wrench and locked with spring cotters. An opening is cast in each end of the dog, through the jaws or sides of which a bolt passes, and in this opening and secured by the bolt is a socket-casting split in a vertical plane. The casting projects on each side of the dog and is hollowed out at each end like a bullet mould, thus forming two spherical seats or sockets into which the ball-ended bolts of the driving-springs fit. The two halves of this socket-casting are fastened together by four three-eighths-inch bolts to prevent their opening and allowing the balls to wear on the joint between them. Similar socket-castings are secured to the two arms or cranks of the hollow shaft by means of bolts or studs which act as crank-pins. All these castings and fittings are interchangeable. Each driving-spring is connected by means of the ball-ended bolts to a socket-casting on the dog, and

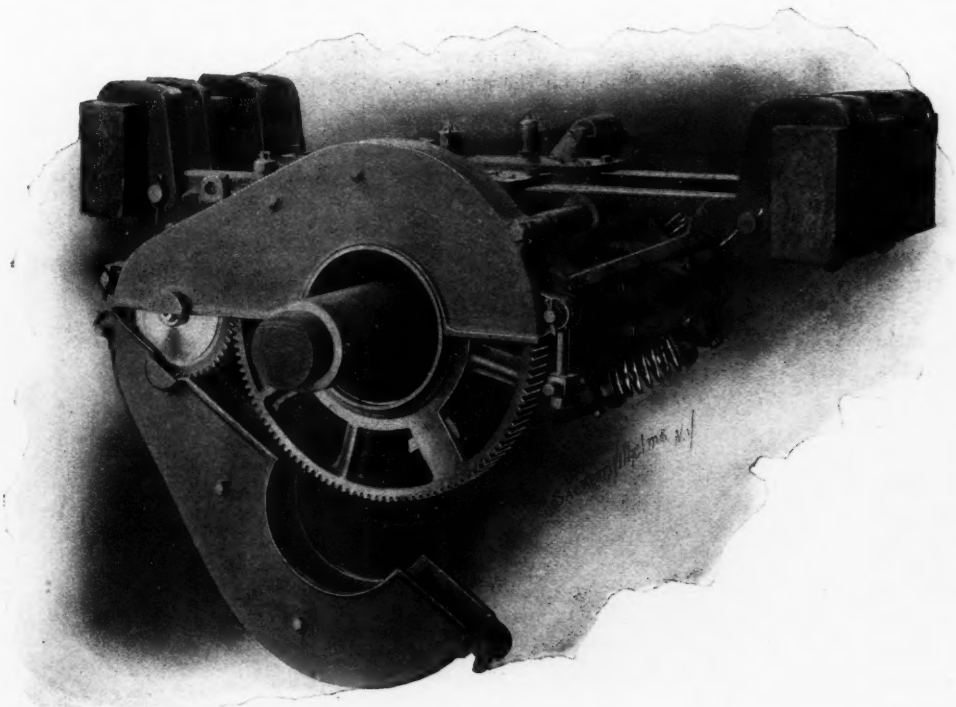


FIG. 4.

one on the hollow-shaft arm. The springs are, initially, neither in compression nor extension, which feature greatly facilitates assembling. The ball-and-socket joints not only admit of the springs assuming all possible angles and positions, but enable them to act either in compression or tension while driving. Two diametrically opposite springs are in compression, while the other pair are in tension, and *vice versa,* depending on the direction of rotation of the axle and hollow shaft. (See Fig. 3.)

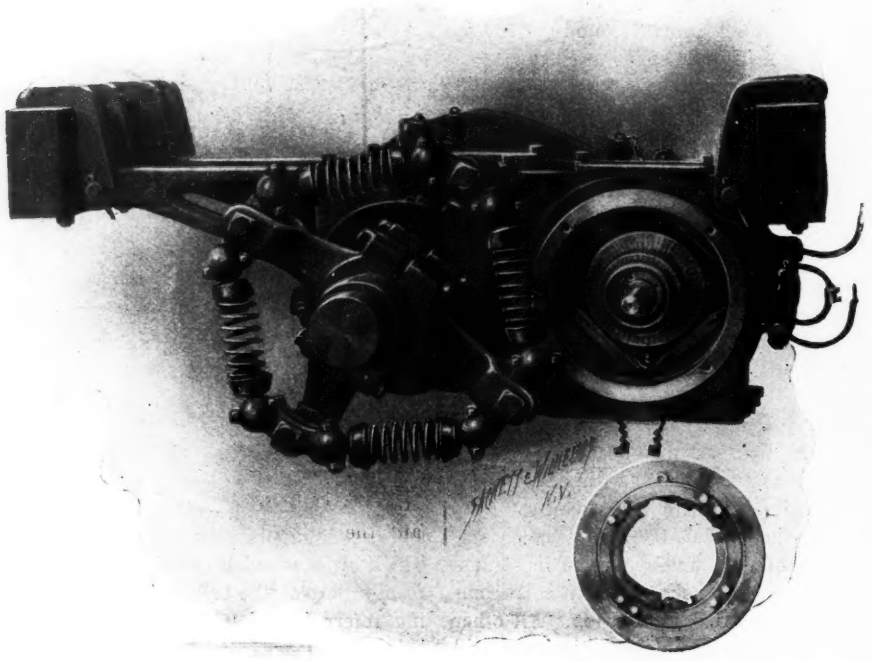


FIG. 5.

The dog need not run true, and no special care need be exercised in mounting it on the axle, it being quite as effective when not so true as when nicely adjusted. The dog is made of malleable iron and cast to fit the taper of the axle. There is a positive advantage in not carrying any of the weight of the generator on the car axle. Supported as the generator is, entirely on the truck frame, it is free from the shock, vibration and pounding which would be communicated to it were it journaled on the axle, as in a street railway motor. It is very easy with this construction to put the generator out of operation by simply taking the dog off the axle. But the greatest advantage which results from this construction is the absence of necessity for trueing up anything in installing the machine. An approximate centering of the axle in the hollowing shaft, and the coarsest kind of work in mounting the dog on the axle are all that are necessary. All the trueing and lining up are done in the shop, and no knowledge of machine work is required of those who install the machine.

All parts of the mechanism which require it are thoroughly encased or otherwise protected. Automatic and profuse lubrication of the shaft bearings is provided. A cut steel gear on the hollow shaft drives a fibre pinion on the armature shaft. In consequence, these are run dry without lubrication of any kind, which conduces much to the cleanliness of the apparatus. (See Fig. 4.)

THE GENERATOR.

The generator is of the ironclad type, having four internal radial salient poles. The poles are placed at an angle of forty-five degrees with the horizontal, two being in the upper and two in the lower half of the generator, which is divided longitudinally in a horizontal plane. The casing which forms the yoke of the fields is extended parallel with the axis of the shaft and is then turned in at right angles, thus forming ends, so to speak. These ends are bored out and have fitted into them round headlike castings which hold the armature-shaft bearings and oil-wells. When these heads are in place the generator is almost hermetically sealed, and is absolutely dust and waterproof. Suitable hand-holes or doors are provided in the generator casing for purposes of inspection, etc. The two heads which carry the armature bearings are each held in place by four bolts, two of which are tapped into the upper half of the generator casing and two into the lower. By this construction the lower half of the generator may be removed, leaving the armature in the upper half, or the armature may be removed with the lower half. The heads being nicely fitted to the casing, ensure the perfect alignment of the armature shaft, no steady pins or other trueing devices being required. By removing the head-casting at the commutator end of the generator, and detaching the flexible cables from their respective brush-holders, the entire brush mechanism, to be described later on, may be removed without disturbing any of the working parts. (See Fig. 5.)

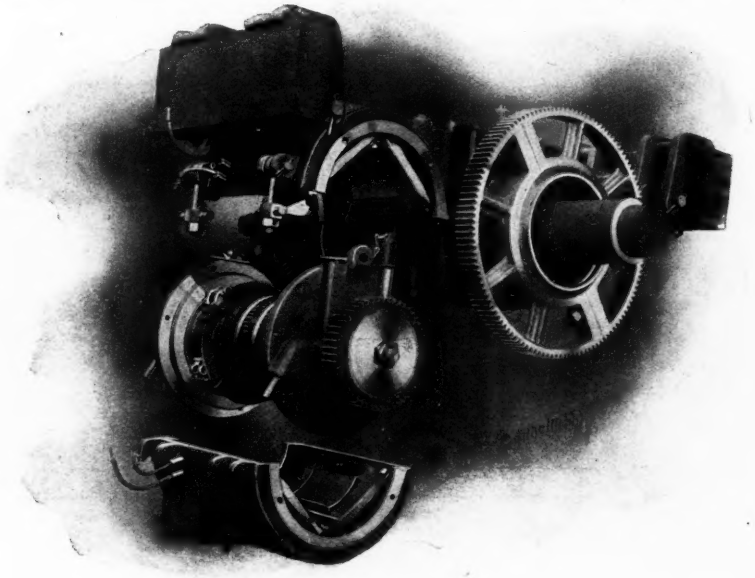


FIG. 6.

The armature is of the four-pole drum type, having a two-circuit singly reentrant drum-winding of the straight-cut

or barrel type. The coils are wound on formers and afterward placed on the armature, thus providing a perfectly balanced winding both electrically and mechanically. The core of the armature consists of the usual annular stampings, slotted to receive the coils, and mounted on a ventilated spider. The central portion of the spider forms a sleeve which is extended at one end to support the commutator. The sleeve is bored out to take the armature shaft, which is suitably keyed and otherwise secured. This arrangement permits the armature and commutator to be quickly taken off the shaft without disturbing the windings, thus affording a ready means for making repairs either to the shaft or to the armature itself. The construction of the armature, shaft and commutator is extremely substantial. All the running parts are heavily proportioned, and are designed to resist the heaviest shocks and stresses.

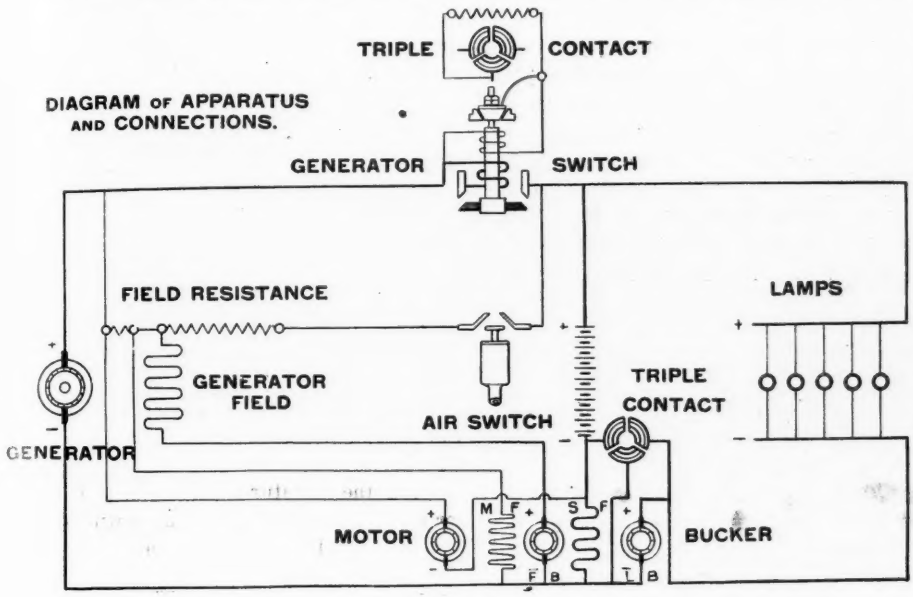



FIG. 7.

The generator is connected as a plain shunt-wound machine and is self-exciting. Hence, there is but a single winding on the field, each pole being excited by one coil. (See Fig. 6.)

The armature winding, being of the two-circuit type, requires but a single pair of brushes to take the current from the commutator, but, for purposes hereinafter explained, two pairs of brushes are employed.

GENERATION AND CONTROL OF THE CURRENT.

The problems under group (*b*), as previously stated, are principally of an electrical nature. Being provided with a generator driven by the car axle which will supply the required electrical energy to operate the lamps and charge the storage battery, there are four conditions which must be electrically and mechanically provided for, and the operations they entail automatically performed, before the system can be declared operative.

THE POLE-CHANGER AND AUTOMATIC BRUSH MECHANISM.

First—Provision must be made for the fact, that the direction of travel of the car will be reversed, and hence the direction of rotation of the armature of the generator will suffer a reversal. This would render a self-excited generator inoperative, or would cause a reversal in the polarity of the brushes or terminals of a separately excited machine. It being highly improper to attempt to charge the storage battery with a reversed current, and for other reasons, means must be provided whereby the polarity of the generator terminals is preserved, no matter which way the car may chance to travel. In this system, the polarity of the terminals is preserved in the following manner: The brush-holders are mounted on a carrier, which is supported on antifriction bearings, which enable it to rotate freely within the casing of the generator. The friction between the brushes and the commutator is sufficient to cause the former, and with them the carrier, to be dragged around as the commutator revolves. The angular motion of the carrier is arrested by means of a stop. When the armature revolves in a right-hand direction, the brushes and carrier are rotated to the right and arrested by the stop in the correct position for commutation. When the armature revolves in a left-

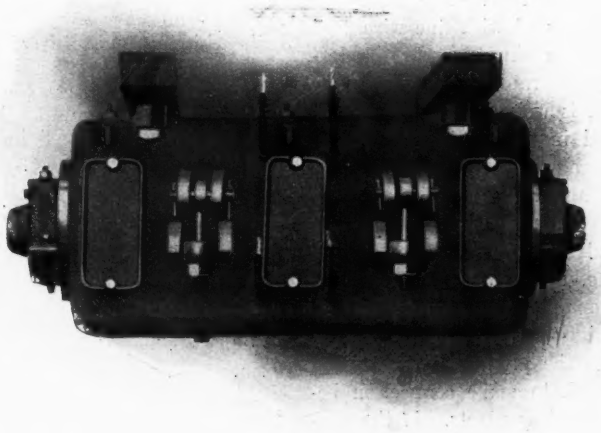


FIG. 9.

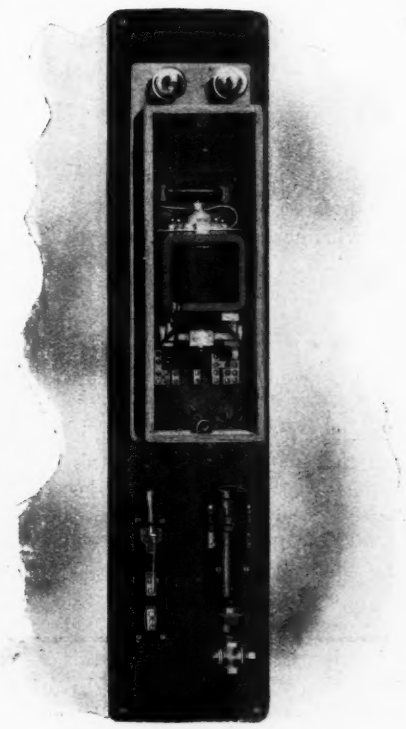


FIG. 8.

hand direction, the brushes and carrier are rotated to the left into a position also correct for commutation, but a position such that the polarity of the brushes would have been reversed, had not a reversal of rotation in the armature taken place simultaneously. But the rotation of the armature having been reversed, and also the position of the brushes, the actual polarity of the latter is preserved. It will be apparent that the angular motion of the brush carrier need be but ninety degrees in a four-pole generator, such as is employed in this system.

The stop which arrests the motion of the carrier is removable, in order that, for inspection purposes and the renewal of brushes, the carrier may be turned completely around, and all the brushes and holders brought opposite the hand-holes in the generator casing.

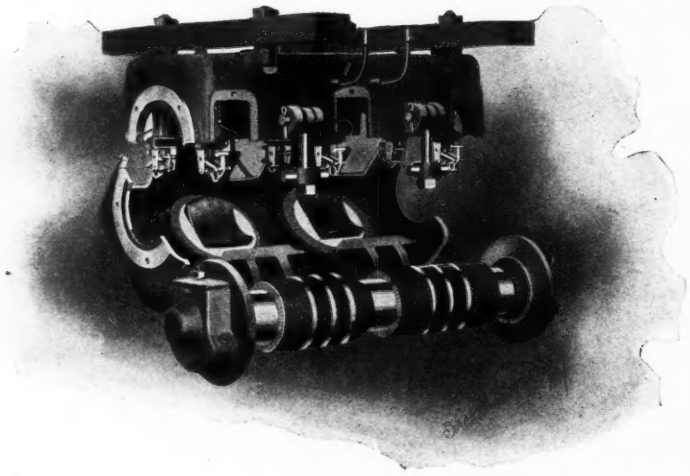


FIG. 10.

As before mentioned, a single pair of brushes would suffice to take the current from the commutator, but by using four brushes, or two pairs, a shorter commutator is possible, a more symmetrical disposition of the brushes is secured, and the adequate friction between the brushes and the commutator is obtained, without undue pressure on a single brush. The brushes of similar polarity are connected together in the usual manner, while flexible cables, which are readily detachable, convey the current from the brushes to the stationary terminals of the generator. Thus it will be seen that in this system the preservation of the polarity of the brushes is secured mechanically, and yet no contacts, switch-blades or other devices, which break or interfere with the continuity of the circuit, are employed. The friction between the brushes and the commutator can not be avoided, and in this system is utilized to advantage.

THE AUTOMATIC GENERATOR SWITCH.

Second—It is necessary to provide an automatic switch which will complete the circuit between the generator and the storage battery whenever the speed of the former, and consequently its voltage, is equal to or greater than that of the battery. On the other hand, this switch must likewise break that circuit whenever the voltage of the generator is less than that of the storage battery, by virtue of a reduced or zero speed. The object of this is apparent. The automatic generator switch opens and closes the circuit between the generator and the storage battery electrically, and is controlled directly by the generator voltage. It consists of a rectangular iron frame which forms the magnetic circuit of the solenoid and supports the insulated contacts. Within the frame are two concentric coils, constituting the solenoid. They are made entirely separate to facilitate construction and repairs, and are held in place by a central tube. The inside, or lifting coil, is wound with fine wire, and is connected as a shunt across the terminals of the generator. The outside, or releasing coil, is wound with heavy wire and connected in series with the generator and storage battery. Within the central tube, and free to work in a vertical direction, is a soft iron plunger attached to and insulated from which is a laminated metal brush. When the generator develops its normal voltage of sixty-four volts, the fine wire or lifting coil will raise the plunger, thus causing the metal brush to make connection between two metallic contacts. If the generator voltage is increased, current will flow from the same through the contacts, brush and series coil, and through the battery, the series coil being wound in such a direction that this current aids the shunt coil in holding up the plunger and brush, maintaining a better contact for increasing current. When, however, the voltage of the generator becomes less than that of the battery, current will flow from the battery in a reverse direction through the series coil and generator and oppose the action of the shunt coil. The weight of the plunger and brush is now sufficient to cause the opening of the switch by gravity. No springs are used to secure the adjustment. Adjustment is made by varying the length of the air-gap, and when once made is permanent. Carbon contacts, on which the final break takes place, protect the metallic parts against injury by arcing. (See Fig. 7.)

Upon the top of the iron frame of the automatic generator switch is mounted a triple contact, consisting of a three-part segmental socket and a conical plug fitting the same. The plug is raised and lowered by means of a tail-rod attached to the plunger of the switch. When the plunger is down and the generator switch open, the plug connects the three segments together. When the plunger and plug are raised by the lifting coil the triple contact is broken. The plug is insulated from the tail-rod, and a flexible conductor permanently connects the plug with an insulated terminal, also mounted on the iron frame. One lead of a resistance coil, located in the upper part of the switch-box, is connected to this insulated terminal, and the other lead is connected to the front segment of the triple contact. The negative lead of the generator is also connected to this segment. The leads of the lifting coil are connected, respectively, to the positive of the generator and the terminal to which the flexible conductor is attached. Thus it will be seen that when the plug establishes the triple contact, it also short-circuits the resistance coil. When the plug is raised, it throws the resistance into series with the lifting coil.

The resistance is thrown into series with the lifting coil: (1) To reduce the current and consequent heating in the coil, which would otherwise change its resistance and alter the adjustment of the switch; (2) to reduce the magnetizing effect of the coil, so that less discharge current will be required in the releasing coil to open the switch as above explained.

The function of the triple contact is to short-circuit the lamp bucker and series field, to be described later, thus avoiding the drop that would otherwise take place in the lamp circuit when the battery was discharging, and to render the bucker inoperative at speeds below twenty miles per hour when the generator switch is open.

At the top of the switch-box are shown two pilot lamps connected in series across the generator terminals. The lighting of these lamps affords a visual indication that the generator is in operation.

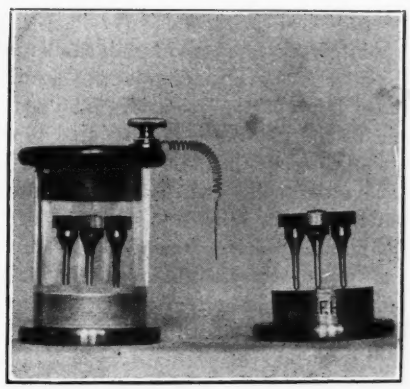
Fig. 8 represents the switch-box and switches complete. The cast-iron cover being removed, exposing the automatic generator switch, with its triple contact and resistance coil. Below are seen the hand switch and air switch.

*(To be continued.)*

## THE BRANLY COHERER.

BY C. L. DURAND.

One of the interesting features of the Paris automobile show, which has recently closed, was the exhibit of the Branly-Popp aerial telegraphy system. Among other apparatus the exhibit contained an automobile provided with a high mast arm for transmitting the signals and equipped in the interior with a complete set of apparatus. A large company has been formed in Paris, headed by M. Victor Popp, a prominent engineer and director of various electrical enterprises. The company proposes to establish a somewhat novel system throughout the city. News is to be supplied to the subscribers from a central station which is connected with various substations by a system of masts and the substations will be put in communication with the subscribers. To show the practicability of the system and the possibility of sending the messages in a large city, the company has erected four complete stations in the central part of the city, the first at its headquarters, Place de la Madeleine, the second at the Havas commercial agency, near the Bourse, and the two others in the offices of two of the leading newspapers, the *Journal* and *Figaro*. These different stations have masts erected upon the roof, and they have been in constant communication for some time past. There seems to be no difficulty in the transmission, and the company, after thus showing the practicability of the system, proposes to carry out the subscriber system in the following way: A central transmitting station will be established in the city, preferably near the Bourse. The station will constantly receive all the important news of the day by telegraph and telephone, both city and foreign news. It will contain all the important happenings of a financial, social or commercial interest. As soon as the news is received at the central station it will be transmitted by aerial telegraphy to all the receiving stations, of which it is proposed to erect eighty or more in the city and suburbs. The posts will then have the news carried by cyclist messenger boys to the residences of the subscribers in each district at stated intervals during the day, say every half hour. The subscribers will thus be able to follow all the important happenings of the day, either local, home or foreign news, and will be next posted as to markets, stock quotations, political events, accidents, etc. The relatively low price of subscription will put the system within reach of a great number of persons of all classes, some for their own pleasure and others for business purposes. Besides the private subscribers, the news will be supplied to clubs, hotels and cafés where it will be preferably posted on a bulletin board, and this will increase the popularity of the establishments which are thus provided. If such an arrangement is carried out it will be somewhat unique and will be of great interest in developing the commercial and private interests of a large city. One of the interesting features is the way in which the news of the races will be obtained. For this purpose a specially designed automobile is to be used. This has already been constructed, having been built by Henry Popp at the Bergerac works. Mounted on the top is a high mast of bamboo. Below are four cross-pieces resting on the roof of the vehicle and from their outer ends are attached the stay-wires which hold the mast upright. On the day of the races the automobile will proceed to the tracks, which are located around Paris within a radius of twenty-five miles. When in running order the mast is dismounted and when the automobile reaches the grounds it can be quickly set up in place. In the interior of the vehicle is a complete set of aerial telegraphy apparatus and the races will be followed at each instant and the results constantly transmitted to the central post in the city, and from there to the subscribers. The automobile can of course be used to proceed to any point near the city in case of accidents or other events, and it can send the news over a distance of thirty miles or more. The current is furnished by a set of accumulators which are kept charged by a small dynamo. The latter is driven by the gasoline motor of the automobile through a mechanical device; the motor gives about fifteen horse-power. Among other apparatus is a balloon which can be used to suspend the transmission wire at the proper height if desired, and a kite has been adopted for the same purpose. The balloon can be quickly filled out by a set of hydrogen tubes contained in the vehicle.



THE BRANLY COHERER.

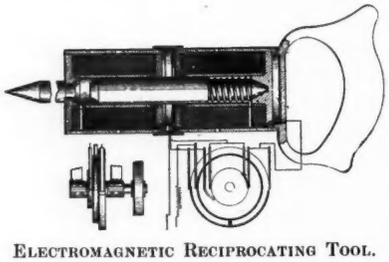
As to the instruments employed, the company is using an improved system which has been mainly designed by Professor Branly, the well-known scientist and inventor. By using a contact formed of an oxidized metal and a polished metal, he obtained a coherer which proved to be very regular in its action, as well as having a sensitiveness greater than that of the filing tube. At the same time he made a great improvement by suppressing the independent striking device and thus was enabled to construct a receiver which is much simpler and works more rapidly than the usual forms. The new coherer, the appearance of which will be noticed in the engraving, is formed of a circular metal disc in which are mounted three tapering vertical rods which have their lower points somewhat rounded off and covered with a layer of oxide. The points, which are of carefully tempered steel, are first well polished, then oxidized at a determined temperature in a furnace. The upper plate with the points forms a kind of tripod which rests freely upon a lower disc of well-polished steel. The degree of oxidation of the points which determines the thickness of the layer, and the polish which is given to the disc, play an essential part in the cohering action. The slight layer of oxide does not seem to deteriorate appreciably with time. The coherer thus formed is enclosed in a case formed of a glass tube with ebonite end-pieces, noticed on the left. The whole is not more than two inches high. The current is brought to the top disc by a silver wire passing through the top cover. Some of the coherers have a lifting screw by which the wire may be drawn up, and the tripod is thus lifted off the lower disc when out of action. This form of coherer has been found extremely sensitive to shocks, and this made it possible to mount it directly upon the Morse receiver and utilize the striking action of the armature lever of the instrument instead of the usual independent striker. To carry this out, the support at the end of the instrument which carries the striking screw of the lever is enlarged to form a kind of shelf upon which the coherer rests. When the lever strikes the screw on the down stroke it gives the coherer a sufficient shock to destroy its conductivity. Owing to its great sensitiveness the coherer uses a lower voltage than ordinary, this being necessary to prevent a continuous circu-

lation of current through the imperfect contact. According to the thickness of the oxide layer, Professor Branly uses for the coherer circuit a Daniell cell of one volt or a Dabilly element of one-half a volt, cut down by a resistance in circuit. In the coherer circuit the battery is connected by one pole to the upper striking screw of the Morse instrument; the current descends through the screw to a platinum plate which is fixed on the armature lever and insulated from it. From the plate it passes by a flexible wire to a sensitive relay and thence to the lower disc of the coherer (including a variable resistance in circuit). The current thus traverses the contact of oxidized metal and returns by the silver wire to the battery. The relay closes the secondary circuit as usual, including the Morse receiver and a battery of two or four Leclanché cells. Under the action of the waves from the transmitting station the coherer contact becomes conducting and the current of one-half volt, reduced by the resistance, operates the relay. This in turn closes the receiver circuit and the striking arm is attracted down, opening the contact between the platinum plate and the upper screw. The arm continues down by its acquired speed and strikes the lower screw; by this shock, which need be but very slight, the coherer becomes non-conducting. The armature rises, establishes the contact, and so on. The lightness of the shock needed for the coherer is also of advantage in reducing the stroke of the armature lever and consequently the speed of working. The new coherer has been in operation for some months past in the four stations above mentioned; it has thus been subjected to a good practical trial and works very satisfactorily. The Paris system is only one of the schemes which are on foot, and an extensive maritime project will no doubt be carried out. The company is now erecting several stations on the north coast of France, and it is proposed to extend the system to the west and the Mediterranean coast. These stations will communicate with vessels over a large radius and will be of great service not only for the merchant marine, but also for the war fleet, which will thus be in constant communication with the shore, and thus by telegraph with Paris. Different types of marine instruments have already been constructed and some of these were placed on exhibition.

Seventy-one patents on wireless telegraphy were issued last year. It is said that there has been issued 109 patents covering this field.

## *Electrical Patents.*

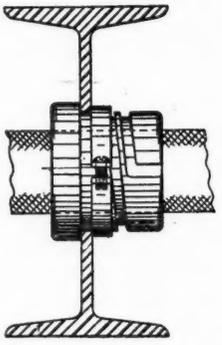
An electromagnetic tool for hammering, chipping, riveting and similar purposes has recently been patented by Mr. Cloyd Marshall, of La Fayette, Ind., who has assigned his entire interest to James S. Andrews, of St. Louis, Mo., and William M. Simpson, of Chicago, Ill. The invention is designed to operate on the order of pneumatic tools now in such general use. A casing is provided, which is made up of two separate sections, detachably secured together, this casing having a handle at one end and carrying a tool, such as a drill, chisel or hammer, at the other end. Within the sections are located two axially aligned solenoids, consisting of coils of insulated wire wound on non-magnetic sleeves. A plunger extends through these solenoids and preferably made of soft wrought iron or steel. Its inner end is reduced to receive a coiled spring and is provided with a pointed or cone-shaped terminal adapted to enter a corresponding socket in the inner head of the solenoid. The outer end of the plunger is also reduced to fit a similar socket in the outer head and to engage the tool. The solenoids are alternately energized by the operation of a commutating device arranged outside of and separate from the tool, the commutating device automatically and momentarily short-circuiting each solenoid at the instant each circuit is broken to discharge the current in the solenoid, due to self-induction. The wiring is so arranged that the retracting solenoid will carry the plunger back to its retracted position and compress the spring located



Electromagnetic Reciprocating Tool.

upon its inner end, whereupon the circuit of the retracting solenoid is broken and the working solenoid is energized to carry the plunger forward to deliver the blow, this operation of the working solenoid being preferably assisted by the spring. The commutating device consists of three discs secured to the same shaft and of different diameters. The shaft is driven in any desired manner. The discs are made of insulating material, and the smallest is provided on its periphery with a short metal strip with which suitable brushes are arranged to make alternate contact. The intermediate disc has on its periphery a continuous metal contact strip, and the largest disc is provided with a contact strip extending half way around its periphery and electrically connected with the contact on the intermediate disc. Suitable brushes coact with these various strips, and are connected with the solenoids and with a suitable source of electrical supply to obtain the necessary actions above described.

The General Electric Company now controls a patent on an insulator devised by Mr. Howard R. Sargent, of Schenectady, N. Y. In the construction of the modern fireproof buildings metallic beams are used to a large extent, and it is frequently desirable or necessary to pass wires or cables through these beams for various electrical systems, and further

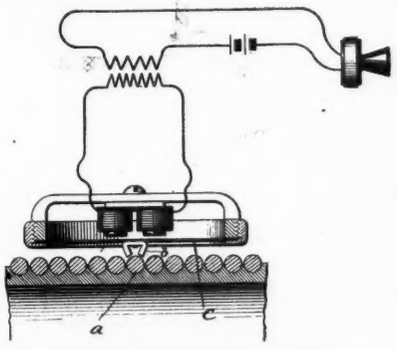


New Method of Making Insulators.

protection for such wires or cables than a covering of insulation is demanded. Hence, it becomes necessary to use a support of insulating material through which the wires may pass and which separates them from the metallic beams. These insulators are made of porcelain or hard rubber or other suitable insulating material, and the character of this material causes great difficulty in providing proper means for securing the insulator in place upon the beams. This invention, however, removes all difficulties of this sort, and provides means for the ready establishment of the insulator in position and for its easy removal therefrom. The insulator, which is hollow, to permit the passage of the insulated cable, is arranged to be placed through an opening of the web of an I-beam, and is provided at one end with an outstanding annular flange that abuts against the web. The other end is provided with a large screw-thread moulded in the porcelain or hard rubber, of which the insulator is constructed. A holding device in the form of a split ring is arranged to be placed upon

the threaded end and is provided with inwardly extending lugs engaging the threads. The ends of this ring are connected by a clamping screw. In use, the insulator is passed through the opening in the I-beam, after which the split ring is threaded upon the same and bears against the web on the side opposite the flange, this ring being securely held in place by screwing the ends together.

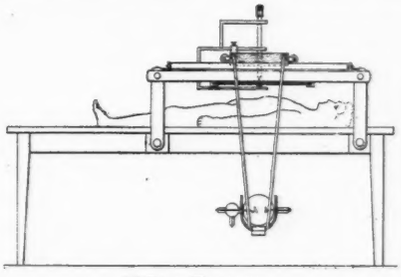
In 1900, an inventor, Mr. Valdemar Poulsen by name, patented an extremely novel method of recording speech, employing undulating or irregular currents of electricity. The plan described by Poulsen for recording the electrical impulses consists in using an electromagnet in a circuit from which such impulses flow, the poles on the magnet resting upon a steel body which is moved with respect thereto. The successive variations in the strength of the magnet are thereby imparted to successive parts of the steel body and are retained thereby for reproduction at any desired time. Mr. William




APPARATUS FOR ELECTROMAGNETICALLY RECORDING SPEECH.

A. Rosenbaum, of New Rochelle, N. Y., has just obtained a patent on an improvement on this method. According to his invention he records the impulses by means of a permanent magnet or electromagnet of constant strength, and he varies the effect which such magnet has upon the steel body by altering its distance from the body in accordance with or in proportion to the strength of the impulses representing the voice or signals, as the case may be. In other words, the poles of the recording magnet are not in contact with the steel body, and the desired effect upon the body is obtained by altering the air-gap between the poles and the body. The steel body may be in the form of the continuous coil wrapped upon a cylindrical body, or a tape or band. Arranged directly over this body is a permanent magnet attached to a spring or diaphragm. This spring or diaphragm normally holds the poles of the permanent magnet out of contact with the steel body, though it would naturally be under some tension at all times on account of the attraction existing between the magnet and the steel body. An electromagnet is arranged behind the spring and is in the secondary circuit of an induction coil, the primary circuit of which contains a telephone transmitter. Now it will be seen that when the voice currents, which are created in the primary circuit by speaking into the transmitter, flow by induction in the secondary circuit, including the magnet, the magnet will be energized successively thereby in accordance with the strength of said currents. This magnet will in turn attract the armature in front of its poles, which will cause the poles of the permanent magnet to approach and recede from the steel body. As a result the air-gap will be varied in proportion to the impulses originally created by the voice, so that the steel body, which is at the same time moving past the poles of the permanent magnet, will be magnetized at successive points to corresponding varying degrees, and such magnetism will be retained by the steel body for subsequent use in reproducing the voice currents in a telephone receiver. In order to reproduce the record thus made in the steel body an electromagnet, whose poles are placed in contact with the body, may be passed over that portion which received the impressions, whereupon currents corresponding to the original currents will be generated in the coil of the magnet and sent over the circuit to a telephone receiver.

Friedrich Moritz, a Bavarian, residing in Munich, has patented in this country a device which he terms an X-ray tracer, and has assigned the same to Voltohm Electricitats-Gesellschaft, A. G., a firm in Munich. The invention consists in an apparatus for ascertaining the exact shape, size and location of bodies by means of the Rœntgen or X-rays. Although it is known that the exact distance apart of two points and consequently the size of a body could be measured with the aid of these rays, it has hitherto not been possible to ascertain by pictorial representation the true shape and size of a body and its location as regards other bodies without previous measurement. By means of the present apparatus this object is obtained, in that the exact outline of the body to be determined can be obtained within a few seconds. In order to attain this object the outline of the shadow of the body in question is drawn upon a projection surface in exactly the same size and shape as the original by the aid of the X-ray of a Rœntgen tube arranged perpendicularly to the surface and moving freely in all directions in a plane parallel thereto. For this purpose the table on which the body to be treated is laid is provided with a suitable supporting frame carrying a drafting plate or surface which is adapted to be placed directly over the body. Upon this frame is also mounted a movable table provided with a drafting or position-indicating device coacting with the drafting surface. A Rœntgen tube is suspended from the movable table and is located directly beneath the operating table and the indicating device, being always arranged directly beneath the latter no matter what position the movable table may assume. Therefore, if the rays from the tube pass perpendicularly across the edge of the body, the edge of the shadow on the screen or drafting surface will coincide with the position of the marking point, and by moving the tube so that the marking point will be caused to travel around or along the entire edge of the shadow and moving a pencil with the marking spot, the exact size and shape of the body



X-RAY TRACER.

will be depicted on the screen. If the tube is not perpendicular below the edge of the body, the rays will pass obliquely across the same and consequently the edge of the shadow thrown on the screen will be at one side of the marking point. Now if the marking spot be moved toward the edge of the shadow, it will carry the tube toward the edge of the body and therefore cause the shadow-producing rays to approach the perpendicular. It will thus be seen that the apparatus permits the making of a visible record of the exact size and shape of the body.

### *Telephones in Railway Work.*

A Buffalo daily paper states that there are now only three railroads doing business in Buffalo which are not equipped with a private telephone switchboard service. When it is considered that none of the long roads running into Buffalo has general offices at that point, this statement indicates the growing importance of the telephone in railway service. Only a few years back, none of the railroads in Buffalo had these facilities. Certain of the railroads there are now erecting telephone lines along the right of way for long-distance service.

# Reviews of Current Engineering and Scientific Literature.

### The Tribelhorn Accumulator.

The Tribelhorn accumulator resembles greatly that old source of electromotive force—the Voltaic pile. It consists of plate-shaped lead trays, piled one upon the other, the lower surface of each plate forming one electrode, and the upper surface the other. This arrangement effects a considerable saving in space, and does away with the need of jars or cases. However, it makes necessary a more frequent overhauling; but this is accomplished easily and without the need of skilled labor by lifting down the plates one at a time by means of a crane. It is stated that there is a saving of space of from fifty to seventy-five per cent by the use of this system. A large battery of this class has been installed recently at the Metropole House, in Zurich. The batteries are arranged in two rows, connected in parallel, giving a capacity of 840 ampere-hours at a three-hour discharge; for 1,000 ampere-hours at a five-hour discharge, and 1,200 ampere-hours at a ten-hour discharge. The batteries were connected to a three-wire circuit of 115 volts pressure. The end cells for voltage regulation are connected to a vertical drum switch, which switch can be operated by means of cords and pulleys from a distance. If desired, this switch can be operated automatically.—*Abstracted and translated from the Centralblatt Accumulatoren (Berlin), February* 1.

### Sparking Coils for Gas Engines.

There are two general methods of igniting the explosive mixture of gas and air in gas engines, one by an incandescent tube or wire and the other by the electric spark. It is stated that the latter method of ignition gives a greater output of the gas engine than does the former, the reason being that electric ignition produces a more rapid explosion and thus gives a higher value for the mean pressure in the cylinder. There are two methods of electric igniting—that using merely a spark coil where the spark of the extra current is utilized, and that employing a Ruhmkorff coil or open core transformer. The latter method gives better results, but has been difficult in application because the slow speed of the vibrating contact has made it impossible to use this system for high-speed engines. Recognizing this deficiency, Messieurs Arnoux and Guerre, by a special study of the requirements, have succeeded in producing interrupters which operate easily and surely at high speeds. Heretofore the limit has been from 1,000 to 1,200 turns per minute with this type of igniter, but with their model they can make and break the circuit of the coil 436 times per second, which will permit of its use on engines having a speed of 5,000 turns per minute.—*Translated and abstracted from L'Industrie Electrique (Paris), January* 25.

### The Effect of an Electric Shock.

The effect of electric shocks upon animals has been studied from a medical standpoint by Dr. S. Jellinik. In general, he agrees with the conclusions arrived at by Mr. F. B. Aspinall in his paper before the British Institution of Electrical Engineers last year, but in some instances he found different effects from those given in the paper just referred to. Dr. Jellinik believes that all diseases which lower skin resistance, such as diseases of the heart and of the skin, predispose to an accident from electric shock—that is, admitting that the effect of electric current is dependent upon the resistance of the skin. He has found that currents otherwise dangerous are harmless to sleeping animals, agreeing in this with Aspinall; but he differs from the latter as to the effect of burning, as burns lower the resistance of the body. He has also found that the longer currents are passed through tissue the lower the resistance becomes. The author then makes some suggestions for reviving persons who have received shocks. In his investigation it was found that the capillaries of the central nervous system were torn, and that blood had escaped and permeated the surrounding nervous system. Such a hemorrhage is not necessarily fatal, but it is very probable that the proposed method of flushing the brain by holding the body with the head down would lead to a secondary hemorrhage, and therefore result fatally. In his opinion it would be better to perform vene-section. Artificial respiration should be continued for hours. Massage of the abdomen and also in the region of the heart, placing the patient in a hot bath, subcutaneous injections of ether, camphor or strychnine should also be carried out. The author expresses his belief that many of those victims who are pronounced dead could be revived by taking the necessary time and trouble.—*Abstracted from the Lancet (London), February.*

### The Radiant Efficiency of the Mercury Arc Lamp.

This article gives an account of some careful work carried out by Mr. W. C. Geer in determining the radiant efficiency of the mercury arc. The Arons type of lamp was used for these measurements, and some difficulty was found in securing steady readings, due to the excessive heat developed, and the uncertainty of the arc. To determine the efficiency the radiation was measured with a thermopile, first directly, then through a water cell, and, lastly, through a cell containing a solution of iodine in carbon disulphide. As the glass of the lamp became very hot it was necessary to correct for its radiation. To do this the radiation from the glass was measured at different periods of time after stopping the arc. By plotting the curve obtained from these readings and by extrapolation, a value was reached for the radiation from the glass before extinguishing the arc. The results of this experiment were given in tabular form, and show that the radiant efficiency of the mercury arc is greater than that of any other illuminant. Measurements which have been made of other lights by various investigators using this same method give the following figures: For an incandescent lamp the radiant efficiency was 0.06; for an arc light, 0.104; for acetylene, 0.105; for Geissler tubes, 0.320. The figure found for the mercury arc is 0.409 to 0.479.—*Abstracted from the Physical Review (New York), February.*

### An Investigation of Self-Excitation of Dynamos.

Herr Leo Finzi has made an experimental and analytical investigation of self-exciting dynamos. These experiments were carried out on a four-pole steel dynamo with an output of 250 amperes at 220 volts. The machine had a drum armature, and the winding of the latter was made in 105 slots, two wires in each. The diameter of the armature was 140 millimetres. The size of the air-gap was three and one-half millimetres. The ratio of pole surface to armature was as four to five. The field winding consisted of 2,600 turns on each pole, and the normal speed was 700 revolutions per minute. Curves were taken at speeds varying from 450 to 800 revolutions per minute. In each case the residual magnetism was brought to the same value, and the speed for each experiment was

kept constant. The time required for the machine to reach its final potential was two minutes and twenty-five seconds at 450 revolutions, the voltage being ninety-nine and six-tenths. The time decreased with each increase in speed, until, at 800 revolutions per minute, but twenty-five seconds were required for the machine to reach its final constant voltage of, in this case, 265.2. Curves are plotted showing the starting characteristics. Each has two knees, but at lower speeds the curves at these points are more rounded, and the straight-line section joining the two becomes shorter. The relation between excitation and residual magnetism was also investigated. The results show that the time required for the machine to excite itself decreases with an increase in the residual magnetism, and at constant speed the final value reached in each case is the same. The analytical investigation takes into consideration the residual magnetism, resistance and inductance of the field, the speed, etc. Equations are then deduced for the machine when operated under these conditions, but it is pointed out that as these do not take into consideration the effect of the Foucault currents set up in the field core, they are not correct except for stable conditions. The article gives very full data of all the experiments.—*Abstracted and translated from the Physikalische Zeitschrift (Leipsic), January* 15.

### *Mercury Vapor Lamps.*

Mr. H. J. Dowsing, of London, secured in 1896 a patent upon a mercury vapor lamp, the patent specifications of which are given in this article. It is stated that this patent has become void through non-payment of fees. The invention relates to an electric lamp, the light of which is produced by the passage of high-tension electric currents through rarefied air, or through suitable gas or vapor. A glass tube was employed of very small bore, such as is used for thermometers, into the ends of which were sealed leading-in wires to terminals within the tube. The tube was partially exhausted, and through it was passed an electric current, preferably alternating. The tube was bent into various forms in order to give a considerable luminous area. It was found an advantage to put in the bulbs into which the terminals are sealed a quantity of mercury or of an amalgum of mercury with other metal. It was of advantage sometimes to warm the lamp before starting, so as to render the rarefied atmosphere within it more conductive by the presence of a little mercury vapor. The claim made for this invention was an electric lamp consisting of a glass tube of a very small bore, connecting two bulbs containing mercury, which are connected by leading-in wires sealed through the glass to a source of high-tension electricity, the atmosphere within the tubes and bulbs being rarefied. —*Abstracted from the Electrician (London), February* 13.

### *Electric Pumping Plant for the Kaiserstuhl II. Mine at Dortmund, Germany.*

In this article M. J. Montpellier gives an interesting description of an electric pumping installation in the Kaiserstuhl II. mine at Dortmund, Germany. Recent developments in the mine, and the sinking of two new pits, have produced a much larger flow of water than previously had to be handled. This amounts at present to about eight cubic metres per minute. The old pumping system was sufficient to raise four cubic metres of water per minute to a height of 300 metres, but gave considerable trouble, and it did not seem advisable to duplicate it to meet the new conditions. It did not seem practicable to install steam pumps at such a depth, a further objection to this system being also the wooden lining of the pits. Under these conditions, an electrical pump was desirable, particularly as the generating plant would also furnish lights and power for operating the hoists and machine tools in the mine. An electrical system was then adopted, and installed by the Oerlikon Company. The pump has three cranks, and at a speed of seventy-five turns per minute can raise five cubic metres of water to a height of 400 metres. This is driven directly by a three-phase induction motor rated at 570 horse-power. The requirements of this installation made necessary a special design of the motor. The size of the galleries would not allow sections larger than two metres to pass, and it was not possible to handle pieces weighing more than 10,000 kilogrammes. For this reason it was necessary to construct the rotor of the motor in two sections. The low speed made necessary a large number of poles, and much care was needed in the design, to prevent excessive magnetic leakage. It was also desirable to have the rotating part heavy, so as to equalize the not perfectly uniform load imposed by the pump. The rotor of this machine has a diameter of 2.99 metres. The air-gap is two millimetres. The winding consists of 162 coils placed in 324 slots. Each coil is formed of nineteen wires 3.6 millimetres in diameter, and connected in parallel. Each group of four coils is formed with a single length of wire, leaving but fifty-four joints to be soldered. The winding is star-connected, the outer terminals being carried to slip rings. A rheostat is provided for starting the motor when the generator is running. This is necessary, as there are other motors operated from the same system. The stator of the motor is also made in two parts. It is supported upon two six-arm spiders from the main bearings. The exterior diameter is four metres, and its width ninety centimetres. The total weight is twenty-eight tons, there being nine tons of sheet iron and 1,400 kilogrammes of copper. The resistance of one phase of the stator is 0.4 of an ohm, the three phases being connected in delta. The resistance of one phase of the rotor is 0.016 ohm. The motor operates at 1,900 volts and twenty-two and one-half cycles per second. When unloaded it absorbs sixty-two amperes, corresponding to sixteen kilowatts. The leakage coefficient was found to be 0.1 with a current of 190 amperes. The friction losses are 3,500 watts. At normal load the motor requires 170 amperes. The power-factor is 0.82, and the efficiency ninety-two per cent, the slip being 2.7 per cent. The maximum torque is 11,500 kilogramme metres, which is double the normal. The generating station contains two alternators, one of 840 horse-power, and one of 150 horse-power, both three-phase. Particulars of the driving engines are given. The main generator is of the revolving field type, and has thirty poles. The diameter of the field is 4.8 metres, and it weighs seventeen tons. The air-gap is ten millimetres. The field coils are connected in series, and each consists of sixty-eight turns of copper wire ten and eleven millimetres in diameter. The exciting current is furnished by an independent dynamo driven by a separate engine. The stationary armature has 180 slots, there being two slots per pole per phase. Each slot contains seven conductors, each consisting of four parallel wires 4.8 millimetres. The efficiency of the alternator at fifty-five per cent of full load is 93.4 per cent, and at full load it is ninety-four per cent. The second alternator is used for all purposes when the large one is shut down. The two machines may be operated in parallel, and the station includes a modern high-voltage switchboard. The circuits consist of three-core cables, each conductor being 120 square millimetres in section. The motor is installed in a chamber in the mine, 300 metres below the surface.—*Abstracted and translated from L'Electricien (Paris), February* 14.

## "The How and Why of Electricity."

The late Charles Tripler Child, author of "The How and Why of Electricity," was a writer of distinction and grace in his chosen profession. The above-named book, the manuscript of which was completed but a week prior to his death, has already taken a firm hold on the favor of critical readers. We present the following typical comments from the engineering, electrical and lay contemporary journals:

[*From Engineering News, February 19, 1903.*]

A SIMPLE EXPOSITION OF APPLIED ELECTRICITY.

This book is the last work of the author, completed shortly before his death last year. It is a short popular exposition of the phenomena of electricity and of its applications. It is smoothly written, in a clear style; the technical expressions used are explained as they result from the exposition of the electrical actions, and the non-electrical reader will be able to read the book easily and without especial study. It may seem remarkable that the author has been able to cover nearly the entire field of electrical applications in the small compass of 127 pages, but we find chapters on the telegraph, on the telephone and the accessory switchboard apparatus, on dynamos and electric railways, alternating-current generators, polyphase motors, incandescent and arc lamps, storage batteries, and even on wireless telegraphy and Rœntgen rays. Yet all these ways of employing electricity in the service of man are described simply and successfully. For example, in four and one-half pages the method of communicating without wires is made to appear an extremely simple thing (which it really is) and the theory of the electrical action taking place is fully presented in a paragraph of a dozen lines. Of course this particular application of electricity is not as useful to the world at large as others, and the explanation of these others is therefore more important. Correspondingly, they are taken up more in detail, and the practical side of their utilization is more fully brought out. Thus, the electric railway is described in all its parts, even in the bonding of the rails, and the series-parallel method of controlling the speed of the motors. It is especially pleasant to note that the author keeps constantly before the reader the practical aspect of the subject, so as to supply him with a healthy basis for thought. For instance, in explaining the dynamo, he points out that power is required to drive the current-bearing armature coils through the magnetic field, and that this power is in precise proportion to the output of the machine. It often happens that a beginner in the study of electricity misses the necessary realization of this truth, and becomes involved in much confusion of thought and loss of time before he learns it.

Nowadays, when so much of electrical mechanism surrounds us in our daily life it is proper that everyone should grow up with a clear, if elementary, understanding of its action. The younger generation is apt to absorb the knowledge necessary for such a comprehension without much study, but a book like the present will be a great help in forming accurate ideas. Many of those who belong to an earlier generation will welcome an opportunity to clear their thoughts on electrical matters. For such the book is written, and in spite of the great mass of electrical literature already existing it is one of the first good books of its kind. The publisher's announcement states that the proceeds of its sale will in large part go to the widow and children of the author, but the book does not need this recommendation; it will find a large circle of readers on its evident merits.

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[*From the Western Electrician, February 21, 1903.*]

For the purpose for which it was written this little book is in every way admirable. The only criticism one can make is to express the wish that there was more of it; and as every writer, technical or non-technical, wishes to leave the reader in that gratified frame of mind where the ending is regretted, the desire that Mr. Child had been able to leave more of his clearly written descriptions of electrical methods and apparatus must be taken as a compliment. In truth, the author of this book, whose untimely death is still lamented, was just the person to write it, for he not only possessed the requisite knowledge, but—what is rarer—he had the ability to set forth in language concise and easily understood the principles of the science and the methods of the art of electricity. In the work under review only the art of electricity is considered. The author explains how a familiar electrical apparatus is operated, and he does it with close adherence to technical truth, without the aid of a single mathematical demonstration and so that any person of average intelligence can assimilate the text. That this accomplishment requires ability of no mean order will be admitted by any one who has essayed to write on technical subjects. Mr. Child has left a good book—one that we can heartily commend to the non-technical readers for whom it was written; they will not be led astray by platitudinous nonsense, but will receive solid, exact information, if simply expressed. The work should have a large sale, and, as a large share of the proceeds will go to the widow and children of the author, we hope that it will.

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[*From New York Sun, December 27, 1902.*]

LIGHT FOR ALL ON ELECTRICITY.

Electricity plays so great a part in modern life that every one meets it in one form or another every day, and many people are annoyed because they do not know something about it. The information they desire is supplied, so far as it can be without mathematics or technical language, in a very well-executed little book, "The How and Why of Electricity—A Book of Information for the Non-Technical Reader," written by the late Charles Tripler Child, who was technical editor of the ELECTRICAL REVIEW, and published by the Electrical Review Publishing Company. It explains how electricity is generated and the various practical applications, from the telegraph to the radiograph and wireless telegraphy, in simple and clear language that every one can understand. The descriptions are helped out with cuts and diagrams that really explain. We know nothing that gives so much real help on a difficult and complex matter in so short a space.

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These expressions reflect very accurately the tone of the opinion which has been formed by readers of this book. It is gratifying to know that in every branch of professional and lay life this timely work has met with a cordial reception.

## Guard Wires on Electric Tramways.

The British Board of Trade has issued a new set of regulations for installing guard wires on electric tramways. Guard wires are required wherever telegraph or telephone wires, unprotected with a permanent insulating covering, cross above, or are liable to fall upon or be blown on to the electric conductors of a tramway. Each guard wire should be well grounded at one point at least, and at intervals of not more than five spans. The earth connection should be made by connecting the wire through the support to the rails by means of a copper bond. Guard wires should, in general, be of galvanized steel, but may be of bronze or hard-drawn copper in districts where steel is liable to excessive corrosion. In general, these wires must be installed at a minimum height of twenty-four inches above the trolley wire. Where there is but one trolley, two wires parallel to this—one on each side, at a horizontal distance of eight inches from the trolley wire—are necessary. If there are two trolley wires not more than twelve feet apart, but the telegraph wires do not weigh more than 100 pounds per mile, two guard wires are sufficient, stretched a minimum distance of twenty-four inches above the former, and on the outside at a horizontal distance of eight inches from the trolley wire. If the telegraph wires weigh 100 pounds or more per mile, this latter arrangement is sufficient if the trolley wires are not more than fifteen inches apart. Where the trolley wires are separated by a distance of from fifteen to forty-eight inches, three wires are required parallel to the trolley—two on the outside, a horizontal distance of eight inches, and the other midway between the two trolleys, all at a minimum distance of twenty-four inches above the trolley wire. If the distance between the wires is over forty-eight inches, and the telegraph wires weigh more than 100 pounds per mile, two guard wires are required for each trolley wire as for a single wire. Guard wires are also required where telegraph wires do not cross the trolley wire, but are apt to be blown against it. Where a telegraph wire may fall upon an arm or span wire, and so slide down on to a trolley wire, guard hooks must be provided.

# INDUSTRIAL SECTION.

*ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS.*

## *Automobile Charging Outfits.*

There is every indication to-day that there will soon be a very considerable increase in the number of electrically propelled vehicles. Several important conditions are responsible for this, the expiration of basic patents on storage battery construction, leaving the field open for more or less promiscuous manufacture and the great increase in interest which is being manifested by the manufacturers of storage batteries, being essential promoters of a new condition of things.

With the increasing popularity in the use of electric automobiles, there has come a realization of the importance of properly taking care of the storage battery. The length of life of the storage battery is dependent in not a little measure upon the proper charging of the batteries. With unskilled attendants there is always the possibility of overcharging, or in some other way injuring or crippling an otherwise perfect set of plates. The accompanying illustrations show a type of charging outfits which has been designed by the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.

Fig. 1 shows the switchboard and rheostat for station work for charging eight vehicles, the full capacity of the board being twelve vehicles, by the addition of rheostats. These are intended for use in public stations where several vehicles are to be charged simultaneously. Under these circumstances it is desirable to have all of the control at one central point, and these switchboards are designed for this purpose, the voltage and current of any vehicle on charge at any charging stand being determined and controlled at the board. Each switch on the switchboard is numbered and corresponds with the number on its rheostat and its charging stand. By throwing a switch to the left the battery is placed on charge, and by throwing it to the right the ammeter is thrown in and indicates the current. By pressing the push-button corresponding to any switch the voltage reading at the corresponding stand can be taken. Opposite each switch is placed a hook which is given a number and on which the charging record of a battery may be kept. A separate push-button gives the voltage reading on the line beyond the rheostat.

These switchboards may be connected to any 125-volt, direct-current line, whether from a central station, a motor-generator set, or from an independent shop circuit.

Fig. 2 shows a typical switchboard for private outfits. These are intended for private stables where the current is delivered to the switchboard with the characteristics required for charging. A battery-charging series rheostat is necessary with it to control the charging rate. For single vehicles, the automatic circuit-breaker for stopping the charging when the battery is full is mounted directly upon the panel with the meters and with the fused main switch. The cable of the charging plug leads out from terminals behind the panel. Where it is desired to charge two, three or four vehicles at a private stable, different panels not having circuit-breakers, but two or four switches are furnished.

Fig. 3 shows a typical direct-connected, direct-current motor-generator set. These are intended for either public or private outfits. This set transforms high voltage direct current to the proper voltage for charging. Direct-connected, alternating-current motor-generator sets are also furnished which transform alternating current to the proper voltage, direct current for charging. These sets are composed of standard multipolar, direct-current, shunt-wound motors, or of standard induction motors coupled or belted to multipolar, direct-current, shunt-wound generators.

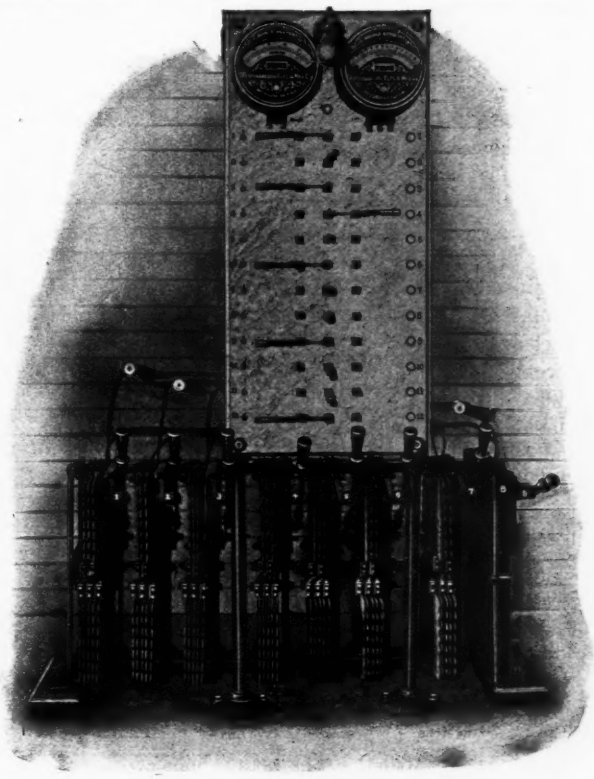


FIG. 1.—SWITCHBOARD AND RHEOSTAT.

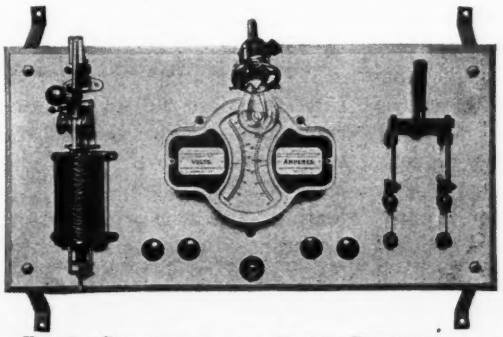


FIG. 2.—SWITCHBOARD AND CIRCUIT-BREAKER.

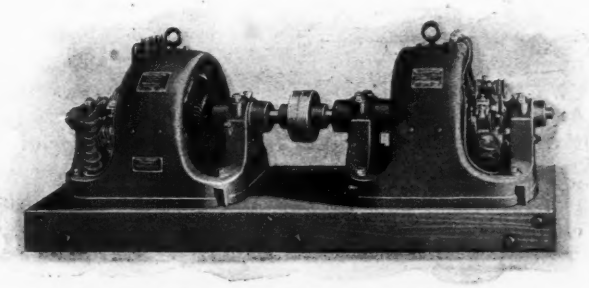


FIG. 3.—MOTOR-GENERATOR SET.

### *Frictionless Wheeled Duct Rods.*

The facility with which these rods are coupled and uncoupled, and the ease with which they are pushed into the ducts, make them very popular in this rapidly expanding field.

These rods have been evolved by practical conduit workmen, and possess all the good qualities of the solid joint, having in addition, the advantages of being quickly connected and disconnected, and of being easily pushed or drawn through the ducts.

In the construction, special provision is made for the couplings becoming rigid when the rods are pushed through the ducts, and flexible when they are pulled. This flexibility of the couplings allows a considerable variance when crossing a manhole, making it easy to take another duct out of line with the first. The rods become again rigid when pushed into the other duct on the opposite side of the manhole. The rods can not become uncoupled while in the ducts, owing to the fact that the rear end of a rod has to be raised to an angle of forty-five degrees before it can be separated.

The couplings are made of hard bronze, the wheels of chilled cast iron, and the rods of first-class hickory, seasoned in oil. The rods are fastened securely in sockets, with a wedge at the inner end.

The wheels save friction and consequent wear and tear on the rods themselves. It is stated that one man is able to push with ease a set of 200 rods or 600 feet. The wheels also act as a guide to the rods, causing them to take a bend or curve as great as two and one-half feet in twelve, and ensuring two and one-half-

WHEELED CONDUIT RODS.

inch duct opening throughout the entire length of the section.

James S Barron & Company, manufacturers of and dealers in electrical supplies, West Broadway and Franklin street, New York city, are the sole agents for these rods.

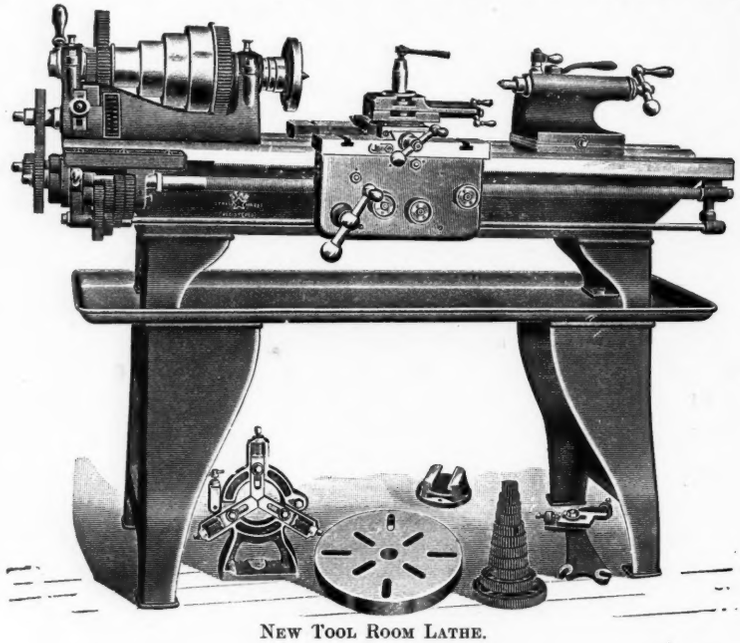
### *A Wireless Fire-Alarm.*

From *Lloyd's Weekly News* (London) information is obtained that a fire-alarm was recently transmitted from Streatham green to Mitcham lane by Marconi wireless telegraph in advance of the regular fire-alarm systems, by means of which a great saving of time was effected. This achievement opens up a new field of operation for wireless telegraph.

### *A New Tool Room Lathe.*

The accompanying illustration shows the thirteen-inch "Star" tool room lathe, a new size and style, recently brought out by the Seneca Falls Manufacturing Company, Seneca Falls, N. Y. This addition to its line of well-known foot and power lathes, while designed for the tool room, is also for regular shop work.

They are furnished with either plain, compound or rise and fall rest, United States standard, Whitworth or metric lead screw, with or without oil pan, and also with draw-in chuck, taper, gear-cutting and milling attachments, if desired.



NEW TOOL ROOM LATHE.

The head-stock is of the web pattern. The hollow spindle, with one and one-sixteenth-inch hole, is made from a crucible steel forging ground perfectly true, and runs in hand-scraped phosphor-bronze bearings. The cone pulley has four steps and with the back gears gives eight changes of speed. The body of the tail-stock is curved so as to allow the compound rest to swing around parallel with the ways and over the base of the tail-stock, with room to operate the feed screw handle. The tail-stock spindle is arranged with self-discharging centre, and has a spindle-locking device which ensures perfect alignment. The tail-stock is further provided with an adjustable side movement for turning tapers.

The carriage is formed with T-slots for bolting on angle plates, etc., is gibbed to the bed and has a cam-locking device for securing it to the bed when the cross-feed is in use. The tool-post has a collar and shoe which excludes all dirt and chips. If desired, a European tool-post will be furnished in place of regular. The power is transmitted from the spindle to the feed rod entirely by gears and is arranged with three different changes of speed. Changes can be made without stopping the machine, and both cross and longitudinal feeds can be operated independently or in combination, as desired. The feeds are actuated by two phosphor-bronze worms on the feed rod, thereby securing the proper graduations of speed of the two feeds. The lathe will cut all standard threads from three to sixty-four, inclusive, without compounding the gears, and nearly all threads by compounding them. The feed-rack and two small gears are made from steel, and all small parts liable to be bruised are case-hardened.

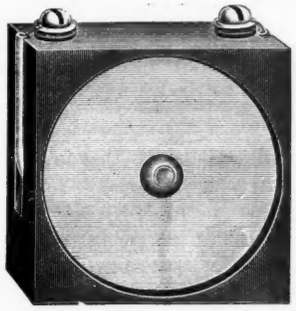
The taper attachment is fastened to back of carriage and is always in position ready for use. The countershaft is provided with improved friction clutches, and has adjustable and self-oiling shaft bearing. The lathe swings thirteen inches over the bed and is made with beds of five, six, eight and ten feet in length.

Carborundum, the new abrasive manufactured at Niagara Falls, N. Y., is composed of carbon and silicon, containing thirty-two per cent of the former and sixty-eight per cent of the latter. It comes from the electric furnace in the form of splendid crystals and great hardness. It is crushed in rolls into grains of various sizes, washed in a solution of acid and water to remove soluble material, dried and sifted to uniform sizes.

### *A New Type of Telephone Transmitter.*

This instrument is known as the "button" type transmitter and derives its name from the "button," a full size illustration of which is shown.

This "button" is self-contained and



"BUTTON" TYPE TRANSMITTER.

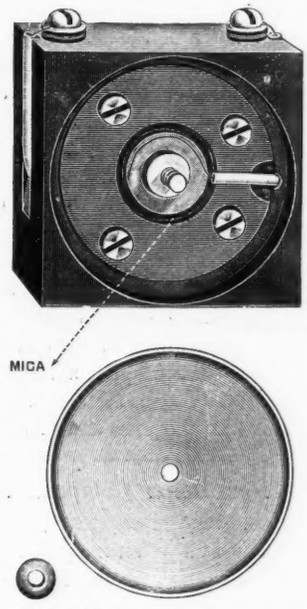
carries within itself two sound diaphragms, a carbon chamber and two electrodes, and is designed to slip into the sound chamber carried at the end of the pivoted arm. Two cords are carried up through the inside of the arm to make the necessary electric connection.

The "button" is not a permanent part of the sound chamber and may be removed and replaced by a new one at any time

CENTRAL ENERGY TRANSMITTER WITH "BUTTON" READY TO SLIP INTO SOUND CHAMBER.

by removing the face-plate and loosening the cord connections.

In its construction the "button" consists of a carbon chamber and two vibratable electrodes carried by mica washers. These mica washers carrying the electrodes are clamped by steel rings to opposite sides of the carbon chamber, effectually sealing the same and making it moisture-proof. Each electrode has clamped to it a sound diaphragm, which diaphragm has no other support. This allows freedom for the periphery to vibrate and ensures the tuning of the two diaphragms to the same characteristic note. It also permits of a perfect and permanent adjustment of the electrodes, inasmuch as the support of the carbon chamber and electrodes can not be at variance with the support of the diaphragm. Means are taken to flexibly secure the periphery of the sound diaphragm to the button after it has been




REVERSE PART, SHOWING WORKING PARTS OF TRANSMITTER.

clamped in place on the electrode. This flexible connection prevents the sound waves from impinging on its under side.

It is claimed that this method of supporting the sound diaphragms not only gives great tone volume but, as well, clear and sharp articulation. It is for this reason that the size of the diaphragms can be so materially reduced from standard, as shown in the cut, and the volume of tone produced still be above that ordinarily obtained. When the "button" is in place within the sound chamber the surface of the diaphragms is transverse to the line of progress of the sound waves and the "button" presents to the opening at the mouthpiece only its edge. This effectually prevents any mechanical injury and removes the necessity of having a protective bottom to the mouthpiece. The sound waves on entering the mouthpiece are divided by the edge of the "button" and then impinging on the beveled sides of the sound chamber are deflected against the diaphragms.

The instrument is constructed throughout of a special hard non-corrosive alloy and each part is cast in a brass mould which ensures accuracy and interchangeability of all parts, while the non-corrosive feature of the alloy eliminates corrosion by the moisture from the breath.

The finish is of black enamel, ensuring a great durability.

These instruments are manufactured by the Fahnestock Transmitter Company, 74 Cortlandt street, New York city.

### *The Nernst Lamp in the Farmers' National Bank, Pittsburg, Pa.*

The Farmers' National Bank Building, which is to be the largest structure in Pittsburg and one of the tallest office buildings in the world, is nearing completion and will be occupied early in March. Contracts for the electrical apparatus have been signed and most of the apparatus is already in place. The generating plant consists of three 150-kilowatt and one 75-kilowatt machines.

The lighting contract was the most hotly contested of any in the building, and the outcome is that the entire building is to be lighted with Nernst lamps made by the Nernst Lamp Company, of Pittsburg, and supplied by the Doubleday-Hill Electric Company, of the same city.

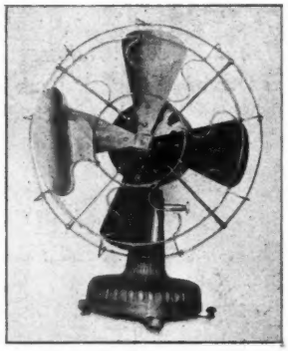
Alden & Harlow, the architects for the building, decided on the Nernst lamp because of the beautiful quality and steadiness of the light, the absence of shadow and the high efficiency. There are to be installed 1,000 fifty-five-watt single-glower, 1,250 eighty-eight-watt single-glower, 20 two-glower and 20 six-glower lamps.

### *A Systematic Method of Calculating the Dimensions of Dynamo Electric Machinery.*

At the recent meeting of the American Association for the Advancement of Science, held in Washington, D. C., Professor Carl Kinsley, of the University of Chicago, presented a paper entitled "A Systematic Method of Calculating the Dimensions of Dynamo Electric Machines." In this, the dimensions were arranged that a set of three simultaneous equations gives the relations existing between the diameter of the armature, its length, and the number of conductors in the winding. These equations are primarily made to depend upon considerations which will determine the satisfactory operation of the machine. The first equation depends upon the electromotive force desired; the second considers the rise of temperature allowable, and the third gives the efficiency of the machine.

### *Revolving Desk Fan.*

The accompanying illustration shows a new type of revolving desk fan, as designed by the George C. Towle Manufacturing Company, Lancaster, Pa. The motor carrying the blade and guard revolves upon a ball-bearing, the base remaining permanently in one position. The rotating motion upon its axis is produced by an air deflector mounted at a permanent angle upon the front of the guard. The perpendicular shaft of the bearing extends through to the lower part



Revolving Desk Fan.

of the base where a movable contact is attached similar to collector rings, on which run metal brushes, and brushes are mounted upon a porcelain base which also holds the resistance used in regulating the speed of the fan motor proper. The revolving motion in connection with the motion from the fan blades throws the air in a circular motion instead of in a direct line.

A friction brake is mounted upon the base, and by means of screwing this in or out any number of revolutions of the motor head can be secured. This works independently of the speed regulation of the fan motor.

This fan can be attached with plug and cord the same as any ordinary desk fan.

### *New Electric Storage Batteries.*

At the recent automobile show held in the Coliseum Building, Chicago, the Chicago Storage Battery Company, 1406 Fisher Building, made an interesting exhibit. This consisted of a set of twenty-eight cells of storage battery, a light runabout mounted on a speedometer, and a switchboard with measuring instruments mounted upon it. This exhibit was for the purpose of illustrating the possibilities of this battery which the company is now placing upon the market, it being the first time that these elements have ever been exhibited publicly with a view to entering into commercial operation. Each one of these cells weighs slightly less than six pounds and has a capacity of 100 ampere-hours on a closed circuit of 1.4 volts per cell. The runabout, mounted on the speedometer, required thirty amperes to drive it at a speed of twenty miles per hour, which was indicated by the dial, and with this weight of batteries—twenty-eight cells at six pounds per cell—this amount of current was delivered for over three hours continuously.

Another feature of this particular cell is the absence of both lead and acid. The containing-cells are metal and are the negative side, and the positive electrode is a tri-metallic composition, the electrolyte being a composition alkaline solution.

These cells are also capable, it is claimed, of being charged to a maximum capacity in one or two hours, and are capable of being discharged at practically the same rate if occasion demands. Each cell is hermetically sealed. After the elements of solution have been placed within the containing negative element, the cell is tightly brazed at the covering. This obviates the necessity of standardizing the specific gravity of the solution and avoids any spilling of the electrolyte. The company is equipping a large plant for the exclusive manufacture of storage batteries for all purposes and of all sizes.

### *A New Boiler Compound.*

In almost every locality the water available for purposes of steam power plants is contaminated to a more or less degree with foreign substances which are deleterious to the boilers and engines. The greatest trouble apparently is due to formations of lime and magnesia, which are deposited in the boiler tubes, valve seats, etc., and either form a scale or encrustation which affects the heat-producing capacity or creates a defection in the material of which the boiler or engine cylinders are constructed. To remedy this condition there have been many efforts expended, both by the use of mechanical skimming apparatus in the boilers, and by the addition of chemical compounds to the feed water.

A new compound has been prepared, the function of which is to prevent the precipitation of the foreign substances from attaching to the sides of the boiler tubes or other material with which it comes in contact, and to keep this in the form of a sludge which may be blown off every day, or as occasion may require. This is a compound which is put up in the form of a dry powder containing the necessary chemicals in the proper proportion to keep the feed water in good condition. It is claimed that this powder will not interfere with the lubrication of the engines or contaminate the steam for use for cooking or dyeing. This is manufactured by W. T. Meinzer, 78 Meserole avenue, Brooklyn, N. Y.

## *CORRESPONDENCE.*

### *Corrections.*

To the Editor of the Electrical Review:

I am pleased to note that in your issue of February 14 you have printed the results of the tests made by myself and Mr. H. M. Palmer at the Du Bois shops of the Buffalo, Rochester & Pittsburg Railway. However, a few words seem to have been omitted from the copy furnished to you, the absence of which makes the first paragraph somewhat incoherent. The first two sentences should have read: "The following tests were made with the purpose of ascertaining the amount of power used by various machine tools when operating in regular routine work, and at the same time the power lost in shafting and belting in a group-driven system. They also indicate the load-factor of such a system, which, to be more explicit, may be stated as follows:" etc. I believe this will make clear a difficulty which must have perplexed any one who read at all carefully the paragraph as it appeared in print.

Geo. H. Gibson.

### *Transformer Construction.*

The following communication has been received from the Oerlikon Manufacturing Company, of Zurich, Switzerland, relating to certain transformers of its make, the data for which have been questioned. The transformers were one 200 kilovolt-ampere of the old type, and one 450 kilovolt-ampere of the new type. With this correction, the data for the former would be 3,420 pounds of copper and 2,000 pounds of wrought-iron core; and for the latter, 1,000 pounds of copper and 5,550 pounds of core. The efficiency of the former is given as ninety-seven per cent, and that of the latter as 97.6 per cent.

To the Editor of the Electrical Review:

Replying to your letter of January 28, we beg to say that our manuscript of the article in question has given the weights in kilogrammes. It appears now that your English contemporary, the *Electrician*, has made an ugly mistake in transforming the kilogramme weights into pound weights. As a fact, the weights given in the *Electrician* of December 5, 1902, page 259, should be multiplied by ten.

Yours truly,

Maschinenfabrik Oerlikon,
G. Huber.

# CURRENT ELECTRICAL NEWS

## *DOMESTIC AND EXPORT.*

LONG ELECTRIC LINE IN THE WEST—A double-track electric line, from Duluth to Texas, with a capital of $70,000,000, is being projected in St. Paul, Minn. It is said that prominent financiers are interested and that application for charters in each state will soon be made.

ST. LOUIS ELECTRIC LIGHTING COMPANY PURCHASED—It is announced that the North American Company of New Jersey has purchased the Laclede Gas and Electric Light Company, of St. Louis, Mo. The capital stock of the Laclede company is $11,000,000. It is also announced that negotiations are now being completed for the purchase of the Missouri Edison Company.

ANOTHER WIRELESS TELEGRAPH COMPANY—The International Wireless Telegraph Company has filed articles of incorporation at Camden, N. J. The company has a capital of $7,500,000, of which $1,000 is paid in. The objects of the corporation are to purchase or acquire the letters patent for the United States granted to any person covering the discovery of wireless telegraphy and telephony, and the invention, improvement, manufacture and use of apparatus.

A NEW YORK-CHICAGO TROLLEY SCHEME—From Ashtabula, Ohio, news comes that a plan is being worked out to control a series of trolley systems, with the ultimate result of forming a complete system between New York and Chicago. Rapid headway is being made on long stretches of road in Ohio, and electric roads from Cleveland are now complete to within eight miles of Ashtabula. East of the Pennsylvania state line roads are also in process of construction.

THE BALTIMORE-WASHINGTON TRACTION DEAL CLOSED—The deal for the sale of the Washington, Annapolis & Baltimore Railroad and the syndicate engaged in building the trolley line between Baltimore, Annapolis and Washington has been closed and the final payment for the property has been made. This deal is the sale of $358,000 of capital stock of the company. A new board of directors has been elected as follows: William H. Lamprecht, Cleveland; Alfred R. Horr, Cleveland; Harry A. Garfield, Cleveland; Calvary Morris, Cleveland; Frank Gosnell, Baltimore. Mr. Lamprecht was elected president.

NEW COLORADO WATER-POWER PROJECT—The New Century Light and Power Company has under consideration a plan for building a power-house in Colorado, about eighty miles from Denver, on the Grand River. The scheme is to build a reservoir and works which will produce about 50,000 horse-power for transmission to all parts of the state. The longest transmission line will probably be to Cripple Creek, a distance of 152 miles, and the shortest to Steamboat Springs, about thirty-seven miles. The line to Denver necessarily will be about ninety-six miles. The engineering work, as outlined by the promoters, is one of considerable magnitude. The dam will be 181 feet high, 300 feet across, and 200 feet in width. A tunnel will have to be driven some four miles, with a capacity of 1,200 cubic feet of water a second. The officers of the company are R. G. Munn, president; R. L. Harper, secretary and treasurer, and F. W. Hart, chief engineer.

## *PERSONAL MENTION.*

MR. J. S. SPEER and wife were registered at the Imperial Hotel, New York, for several days last week.

MR. EDWIN HAWLEY has been elected a director of the Postal Telegraph-Cable Company.

MR. WILLIAM COALE, Warren, Ohio, a prominent manufacturer of incandescent lamps, was in New York city during the past week.

MR. WALTER CAREY, Milwaukee, was a visitor at the Manhattan Hotel, New York, last week. Mr. Carey is vice-president of the Milwaukee Electric Company.

PROFESSOR W. H. FREEDMAN, professor of electrical engineering at the University of Vermont, has been engaged by the aldermanic committee on the electric lighting plant, as an expert to determine the total cost of establishing a plant in Burlington, Vt., and make a report.

MR. C. H. WILMERDING has been appointed consulting engineer for the Chicago, Rock Island & Pacific Railroad Company, in connection with the construction of its new shops at East Moline, Ill. These shops will be among the largest and most complete that have ever been built.

MR. H. H. GEARY, sales manager of the Fostoria Incandescent Lamp Company, Fostoria, Ohio, has secured a contract from the New York Central & Hudson River Railroad Company for 75,000 lamps. This railroad company has had considerable experience in electric train lighting, and this order is to supply all of the roads operated and leased by the New York Central company.

MR. CHARLES S. POWELL, who has been associated with the Westinghouse electric interests since 1893, and who, for the past six years, has been manager of the Cleveland office of the Westinghouse Electric and Manufacturing Company, has been appointed assistant manager of the British Westinghouse Electric and Manufacturing Company, Limited, and has already entered upon the duties of his new position.

MR. H. F. SANVILLE has been elected temporary secretary of the local committee of the Philadelphia section of the American Institute of Electrical Engineers. This branch will hold a meeting at 1122 Girard street, Philadelphia, on Monday evening, March 9. The papers on railroad train lighting by Messrs. Bliss, Farnsworth and Sperry will be presented and discussed. It is expected that President Charles F. Scott, Vice-President Samuel Sheldon, Secretary Ralph W. Pope, and the chairman of the local organization committee, Mr. Calvin W. Rice, will be present.

## *OBITUARY NOTICES.*

MAJOR FREDERICK LUTHER HOLMES, assistant superintendent of the Okonite Company, died on February 26, 1903, at his residence, 172 Lafayette avenue, Passaic, N. J.

MR. FRANK TREMAN WYCKOFF, president of the Wyckoff Pipe and Creosoting Company, of Portsmouth, Va., died at his home, "Spofforth," Strawberry Hill, Stamford, Ct., of Bright's disease, on February 19.

MR. ALLEN M. PENNOCK, who was connected with the electrical department of the Western Union Telegraph Company, died of pneumonia on February 26, at his home, 180 Decatur street, Brooklyn. Mr. Pennock was forty-five years of age, and was a native of Bordentown, N. J.

MR. CHARLES PECK, a pioneer citizen of New Britain, Ct., died at his home, at four o'clock, Tuesday morning, February 24, 1903. Mr. Peck was born on March 16, 1830, and has been active in many fields and departments of the city's growth, having served on the board of street commissioners from 1877 to 1894. He is survived by Mrs. Peck and four children—Mrs. Elihu Thomson, of Swampscott, Mass.; William E. Peck, of New York city; Edward F. Peck, of Schenectady, N. Y., and Mrs. Henry B. Boardman, of New Britain, Ct.

MRS. EMILY WARREN ROEBLING, wife of Washington A. Roebling, died at her home in Trenton, N. J., on February 28. Mrs. Roebling had been in poor health for some time, and in the early part of last week there was little hope held out for her recovery. Mrs. Roebling was a prominent club woman, and very widely known. Although her name finds no place in the official records of the Brooklyn Bridge, upon the disabling of her husband, Washington A. Roebling, she undertook the very difficult task of supplementing her husband's work in the construction of this structure.

### ELECTRIC RAILWAYS.

AUGUSTA, ME.—The legislature has been asked for a charter for an electric railway to extend from the Bangor & Hampden terminus in Hampden through that town, Winterport, Frankfort and Prospect to Stockton Springs, on Penobscot Bay.

BALTIMORE, MD.—It is stated that plans are on foot to build an electric road from Towson to about a mile north of Cockeyville. It is said that $80,000 will be necessary to complete the enterprise, and that this amount can be secured without much delay.

SUPERIOR, WIS.—The Southern Wisconsin Interurban Railway Company has filed articles of incorporation with the Secretary of State. The company is capitalized at $25,000, and proposes to build a road from Janesville to Madison the coming summer.

CRAWFORDSVILLE, IND.—The directors of the Consolidated Traction Company have completed arrangements for the completion of the road. The company has accepted the franchises of both the city and country, and work will begin as soon as the weather permits.

HUDSON, N. Y.—The property of the Albany & Hudson Railway and Power Company was sold recently to Charles H. Werner, representing the attorneys of the Colonial Trust Company of New York, holders of the mortgage of $2,500,000. There was only one bid, for $1,250,000.

AUSTIN, TEX.—The Northern Texas Traction Company has given a $2,500,000 mortgage to the Prudential Trust Company, of Cleveland, Ohio, to secure the issue of an equal amount of $1,000 thirty-year five-per-cent gold bonds. Of this amount, $500,000 will be used for extensions as they may be required.

ZANESVILLE, OHIO—An electric railroad will be built from Marietta to Zanesville by the Muskingum Valley Traction Company, capitalized at $100,000. The incorporators are: S. A. Weller, W. B. Cosgrove, N. P. Shurtz, J. B. England, S. M. Winn. A preliminary survey has been made and part of the right of way secured.

MANSFIELD, OHIO—A statement has been issued by the Citizens' Electric Railway, Light and Power Company, stating that negotiations have been closed whereby new capital will become interested in the company. In all probability the road will be extended to Norwalk, Ohio, and numerous improvements made to the rolling stock and present line.

DES MOINES, IOWA—Articles of incorporation have been filed for the Oelwein & Northwestern Iowa Interurban Street Railway Company, with a capital of $200,000. John Jamison is president; George Given, vice-president; J. W. Hansen, treasurer, and William A. Reed, secretary. The company is to build a trolley line from Oelwein to points in Fayette and other counties.

LA CROSSE, WIS.—The La Crosse & Northern Railway Company will be incorporated to build an electric line from this city to Galesville, Wis., thence north to Winona, Minn. Power will be obtained from Black River, a bill having been introduced in the legislature to allow the company to dam the stream at a point near La Crosse. Work is to be begun in the spring. Those interested in the company are B. E. Edwards, W. S. Cargill, Peter Valier, G. Van Steenwyk and M. Funk.

DECATUR, IND.—Plans have almost been completed by which Cincinnati capital will build an interurban line from Decatur to Springfield, Ill., a distance of forty miles. The charter for the new company, which is to be capitalized at $1,500,000, will, it is said, secure for the company the right of eminent domain under the laws of Illinois. When this charter is obtained it is the intention of the company to consolidate with the Decatur Traction Company. A fifty-foot private right of way has already been secured from Decatur to Springfield.

AKRON, OHIO—The Wooster & Mansfield Electric Railway will build forty-four miles of standard-gauge line to connect Wooster, Millbrook, Shreve, Big Prairie, Lakeville, Loudonville, Perrysville, Douglass, Robinson and Mansfield. Construction is to begin next spring. The company expects to run branch lines from Lakeville to New Philadelphia, forty-five miles; Loudonville to Mount Vernon, twenty-five miles; Loudonville to Ashland, twenty-two miles. The officers of the company are: W. A. Craig, of Shreve, president; J. B. Keys, of Shreve, vice-president and general manager; David Collier, of Plimpton, secretary; J. C. Chesrown, of Shreve, treasurer.

### TELEPHONE AND TELEGRAPH.

PRINCETON, IOWA—A local company has been organized to connect McCausland and Princeton with various side lines. Work will be commenced at once.

HUNTINGTON, IND.—Citizens of Andrews have organized a home telephone system for the town and surrounding country. D. L. Snowden is president of the company.

DE PERE, WIS.—Articles of incorporation have been filed for the Appleton & Freedom Telephone Company, which will build a line between the two places mentioned in the company's title.

PITTSBURG, PA.—The Central District Printing and Telegraph Company has voted to increase its capital stock from $8,750,000 to $10,000,000, and to use the additional stock for extensions and improvements to the service.

BUFFALO, N. Y.—It is the intention of the Marconi Wireless Telegraph Company, it is stated, to establish a plant at or near Montreal for the manufacture of the instruments and equipment used in the Marconi system.

ALBANY, N. Y.—The Independent Union Telephone Company has filed with the Secretary of State a certificate of increase of capital stock from $200,000 to $1,000,000. This company controls all the Home Telephone toll lines in the state.

KALAMAZOO, MICH.—The Kibbie Telephone Company, which has been engaged since last September in building an extension into Kalamazoo, has completed its work and opened its toll office. This will give Kalamazoo telephonic connection with all the towns in Van Buren County and in the southern portion of Allegan, and will reach a number of points that heretofore have been inaccessible.

OMAHA, NEB.—An increase of capital stock from $1,800,000 to $2,400,000 was authorized by the stockholders of the company at the annual meeting held recently. It is planned to spend the entire amount during the year 1903 on extensions, enlargements and improvements in Nebraska and Iowa. Chief among the improvements authorized will be new exchange buildings and switchboards in Omaha, Lincoln and Council Bluffs, placing the wires underground, as ordered by the council in the latter city, together with many minor improvements.

ELIZABETH, N. J.—The Central New Jersey Telephone Company has filed articles of incorporation in Trenton. The company is an offshoot of the Interstate, and the incorporators are men interested in that company. The company is to build four lines. The first will begin at Elizabeth and connect Rahway, Woodbridge, Perth Amboy, South Amboy, Cliffwood, Keyport, Matawan, Middletown, Red Bank, Oceanport, Long West End, Elberon, Deal Beach, Allenhurst, Ocean Grove, Asbury Park, Belmar, Como, Spring Lake, Lake Beach and Sea Girt. The second will tap the first at Rahway, and connect Iselin, Menlo Park, Metuchen, New Brunswick, Milltown, Helmetta, Jamesburg, Englishtown, Freehold, Farmingdale, Manasquan, and reconnect at Sea Girt. The third will start from the first at Elizabeth and connect with Roselle, Cranford, Westfield, Plainfield, Dunellen and Metuchen. The fourth line will tap the last at Dunellen and connect with Bound Brook and Somerville. The authorized capital of the company is $100,000, and the incorporators are: Frederick J. Randolph, Bruce Bedford and Charles Wright.

### LEGAL NOTES.

INCANDESCENT LAMP SUIT—A suit has been filed by the General Electric Company against the Crouse-Hinds Company, of Syracuse, N. Y., for the alleged infringement of incandescent lamp sockets. This suit is based upon the Tournier patent No. 559,232.

ENJOINED FROM USING TRADE NAME—A decree has been obtained by the Babcock & Wilcox Company, in the United States Circuit Court, Southern District of New York, in a suit against the Aultman & Taylor Machinery Company and Thayer & Company, for infringement of the Babcock & Wilcox Company's trade name.

METER SUIT DECISION—The United States Circuit Court of Appeals has rendered a decision in favor of the defendant, in the case in which the Scheeffer meter, manufactured by the Diamond Meter Company, was involved. This suit was on an induction wattmeter being used by the Catskill company. The Diamond Meter Company, of Peoria, Ill., defended the suit.

## ELECTRICAL SECURITIES.

There has been little change in speculative conditions during the past week. The apathy and sluggishness which have characterized operations for some time remain unchanged. There was an apparent effort to bear prices, but this was met with firmness and has, if anything, enhanced the feeling of security for an upward development. It is expected, now that the monetary situation has developed as a speculative factor, that considerable stringency will prevail until well into the spring. It is probable that the average of rates will reach a higher level than has prevailed for the past month. The reports of industrial conditions and earnings in general continue very favorable, and the apparent indifference on the part of the speculative public and professional dealers is largely the result of reaction, and there is extant the greatest confidence that good commercial conditions will be continued.

ELECTRICAL SECURITIES FOR THE WEEK ENDING FEBRUARY 28.

| *New York:* | *Closing.* |
|---|---|
| Brooklyn Rapid Transit | 67⅜ |
| Consolidated Gas | 212¾ |
| General Electric | 195 |
| Kings County Electric | 230 |
| Manhattan Elevated | 140⅜ |
| Metropolitan Street Railway | 136¼ |
| New York & New Jersey Telephone | 162½ |
| Westinghouse Manufacturing Company | 211 |

At the recent annual meeting of the Kings County Electric Light and Power Company, the retiring board of directors was reelected, with the exception of Felix Campbell, deceased, whose place was taken by Edward A. Lesler. A special meeting of the stockholders has been called for March 18, when it is expected that some action will be taken in connection with an increase in the capital stock, which is now $2,500,000.

| *Boston:* | *Closing.* |
|---|---|
| American Telephone and Telegraph | 167 |
| Edison Electric Illuminating | 292 |
| Massachusetts Electric | 92 |
| New England Telephone | 137 |
| Western Telephone & Telegraph preferred | 100½ |
| *Philadelphia:* | *Closing.* |
| Electric Company of America | 9⅛ |
| Electric Storage Battery common | 79 |
| Electric Storage Battery preferred | 79 |
| Philadelphia Electric | 7½ |
| Union Traction | 47 |
| United Gas Improvement | 110¾ |
| *Chicago:* | *Closing.* |
| Chicago Edison Light | 160 |
| Chicago Telephone | 157½ |
| Metropolitan Elevated preferred | 84 |
| National Carbon common | 23 |
| National Carbon preferred | 97 |
| Union Traction common | 9⅞ |
| Union Traction preferred | 40 |

## INDUSTRIAL ITEMS.

THE OSBORN-MORGAN COMPANY, Cleveland, Ohio, has closed some large contracts in Cincinnati, Ohio, Mr. Joseph Melzer, chief electrician of the company, having recently made a trip there for this purpose.

THE H. C. ROBERTS ELECTRIC SUPPLY COMPANY, one of the large electrical establishments of Philadelphia, is now having a new building fitted and equipped for its occupancy. This company expects to move into its new quarters within the next sixty days.

THE FAHNESTOCK TRANSMITTER COMPANY, 74 Cortlandt street, New York city, will be pleased to send to any one interested a booklet descriptive of its "Button" type telephone transmitter. This describes in detail the mechanism and operation of this instrument.

THE MAGNET WIRE COMPANY, New York city, has moved its New York office to new and larger quarters in the John Wolff Building, No. 80 William street. The company is also moving its factory from Newark, N. J., to 104 and 110 East 129th street, New York city.

THE ELECTRIC APPLIANCE COMPANY, Chicago, Ill., is carrying a very large stock of circular loom. This stock is well assorted in all sizes from one-quarter to two and one-quarter inches inside diameter. The immense quantity of this on hand renders prompt shipments an easy matter.

THE NEW YORK & OHIO COMPANY, Warren, Ohio, manufacturer of Packard incandescent lamps, transformers, insulating cloths and varnishes, is making a high-grade line of insulating cloth and varnish for use in its high-potential transformers. Full information and samples will be sent on request.

THE EUREKA ELECTRIC COMPANY, 143 South Clinton street, Chicago, Ill., will be pleased to send to any one requiring information in this direction its latest bulletin in describing the Eureka non-infringing solid-back transmitter. This bulletin describes this apparatus and shows illustrations of the front and back of the transmitter and of the transmitter plunger.

THE WISCONSIN STEEL WORKS, Racine, Wis., has printed a very handy booklet entitled "The Motor Cycle Primer." This describes the apparatus and operation of the Mitchell motor cycle manufactured by this company. This is a four-cycle gasoline motor, and the book gives a great deal of useful information that is very necessary for any one operating such a machine.

JAMES L. ROBERTSON & SONS, 204 Fulton street, New York city, manufacturers of engineering specialties, are securing a great many new orders for their "Eureka" packing. One of the leading features that has made this packing so popular is the long fibre flax used in its construction, this representing the strength so necessary in packing used against high-steam pressures.

THE POSTAL TELEGRAPH-CABLE COMPANY'S list of offices, dated January, 1903, has been distributed. This contains a full list of the company's offices, indexed by states, together with an easily understood tariff index. The book is well printed and substantially bound, and is supplemented by a number of half-tone engravings of the company's offices in different principal cities.

THE STERLING ELECTRICAL MANUFACTURING COMPANY, Warren, Ohio, and 26 Cortlandt street, New York, advises that the sale of the "Sterling Special" incandescent lamps during the winter has been phenomenally large. This lamp, which has been illustrated in the ELECTRICAL REVIEW, has a filament which is mounted in double spiral form, which method is claimed to give an equal radiation of light in all directions.

THE DIAMOND RUBBER COMPANY, Akron, Ohio, is sending to interested parties a sample of special "C. I." sheet packing, which is being placed on the market by this company. On contracts for large quantities the company is prepared to offer this packing at a remarkably low figure, considering the cost of raw material to-day. The packing has a very smooth finish, and the company has found it to be a very popular material.

THE LAWRENCEVILLE MANUFACTURING COMPANY, of Lawrenceville, Va., will build at once a furniture factory and powerhouse. An electric light plant will be installed to furnish Lawrenceville with general lighting and power. This company will be pleased to receive information and catalogues from supply houses, machinery makers and electrical construction companies. Mr. H. C. Risdon is secretary, and Mr. Charles Hooper is general manager.

THE GRATON & KNIGHT MANUFACTURING COMPANY, Worcester, Mass., is receiving numerous enquiries with regard to its offer to send free of charge one of its oak-tanned belts to any manufacturer who would like to test it. This house enjoys an excellent reputation for doing exactly what it agrees to and this offer should be taken advantage of by any one desiring to make an early trial of these belts.

D. L. BATES & BROTHERS COMPANY has recently incorporated with Mr. D. L. Bates as president and general superintendent; A. L. Bates as secretary, and R. H. Bates as vice-president and general manager. The company has recently made several large additions to its factory, and is now ready to promptly fill orders of any magnitude on fan motors, either for electrical or water power. The company is sending an attractive calendar to its patrons.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., has recently published a new telephone catalogue, dated February, 1903. This contains a complete line of the products manufactured by the

Williams-Abbott Electrical Company, for whom the Central company is sales agent. In addition to the Williams-Abbott material, the catalogue contains a list of wires, tools, batteries, and all other supplies used by telephone companies. A copy will be sent upon request.

THE VALENTINE-CLARK COMPANY, with offices at 234 La Salle street, Chicago, Ill., and a number of separate yards, makes a specialty of cedar poles. This company has an established reputation with the prominent telephone, telegraph, traction, and electric lighting interests of the country. All lengths and sizes of tops are continuously carried in stock, and the company announces that it can, at all times, promptly fill any size of an order with seasoned lumber.

THE C. W. HUNT COMPANY, West New Brighton, N. Y., is sending along with an attractive circular, a sample of lubricant plumbago used in manufacturing "Stevedore" hoisting and transmission rope. The "Stevedore" rope for transmission purposes is made four-strand, with a heart from specially selected Manila fibre. A plumbago lubricant is used in laying up this rope, which reduces the internal friction of the fibres on each other, and also makes the rope non-absorbent.

THE ALLIS-CHALMERS COMPANY (Frazer & Chalmers Works), with general offices at Chicago, Ill., has compiled a catalogue of a partial list of users of Riedler pumping, compressing and blowing engines. This gives the name of the company, the type of pump, and data concerning the plungers, capacity, lift, water horsepower, size of discharge pipe, type of motor, cylinders, steam pressure and speed. The catalogue consists of 180 pages and is carefully indexed.

J. H. WILLIAMS & COMPANY, Hamilton Ferry, Brooklyn, N. Y., are the manufacturers of a fine line of iron, steel, copper, bronze and aluminum drop forgings. The new catalogue of this company describes and illustrates the company's specialties, and also gives the dimensions and prices. In addition to the practical value of the catalogue, the cover design is worthy of mention. This shows a heavy eye-bolt and hook supporting a hand wrench, the surface of this being illuminated by the glow of the forge flame.

THE UNION SWITCH AND SIGNAL COMPANY, Swissvale, Pa., has designed a remarkably attractive calendar, and is presenting this to some of its friends. This calendar shows a miniature equipment of a complete signal system, presenting the arrangement of a universal ninety-degree spectacle for two positions, continuous light, lamp on top of post; also double ninety-degree spectacles arranged for two and three positions, and continuous light sixty-degree spectacles applied to a double arm for home and distant signals.

THE DEPARTMENT OF EDUCATION, BUREAU OF MANHATTAN, has issued a series of bulletins of free lectures to the people to be delivered at convenient places in New York city. For mechanics and engineers, as well as the public not engaged in these arts, these lectures present a valuable opportunity for securing accurate information. Programmes may be secured by application to the Department of Education, and no one who desires an education on these lines should fail to take advantage of these fine opportunities.

THE H. W. JOHNS-MANVILLE COMPANY, 100 William street, New York city, is installing its "Salamanderite" paneling in a number of prominent buildings. The great flexibility of this material makes it applicable for almost any manner of construction, especially where any attempt is made at decorative effects, as in wainscoating, ceiling and wall paneling, hard-wood and inlaid work, marquetry effects, etc. "Salamanderite" is fireproof and water-proof, and is made up, if desired, as fac simile to any description of wood.

THE PLUNGER ELEVATOR COMPANY, Worcester, Mass., has just published a catalogue descriptive of its direct-acting hydraulic elevators. Although the principles of construction of the plunger elevators are generally known, the improvements which have been made recently are not generally understood. This system has been developed until its sphere of service has been enlarged so that in recent installations over 200 feet travel is secured, and speeds of from 500 to 600 feet per minute. In the new Ansonia Building, New York city, there are fifteen plunger elevators, the maximum car travel being 223 feet.

THE WILLYOUNG & GIBSON COMPANY has been incorporated under the laws of the state of New York. This corporation has taken over the business formerly conducted under the title of "Elmer G. Willyoung," and will immediately extend the facilities of the old business. It is the purpose of the corporation to cover the entire field of high-class scientific instruments, and also to make a separate department for the supplying of electrotherapeutic and allied surgical appliances for the medical profession. The officers are as follows: Elmer G. Willyoung, president and general manager; C. R. Gibson, secretary and treasurer.

THE PHILADELPHIA TAPESTRY MILLS, manufacturers of tapestries and light carpeting, have contracted with the Westinghouse Electric and Manufacturing Company for a 150-kilowatt, two-phase, engine-type generator. The Dodge Coal Storage Company, of Philadelphia, is building a large coal-handling crane to be installed at the Maryland Steel Company's plant at Sparrow's Point. This crane will be driven by electric motors, and the Dodge company has recently purchased for this purpose one 50-horse-power and two 30-horse-power, direct-current motors, with controllers, from the Westinghouse Electric and Manufacturing Company.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Chicago, Ill., has recently shipped boards of various capacities to the following companies: Texas Construction Company, Port Arthur, Tex.; Northern Indiana & Southern Michigan Telephone and Telegraph Company, Constantine, Mich.; Home Telephone Company, Waverly, Ohio; Twin City Telephone Company, Minneapolis, Minn.; Citizens' Telephone Company, Coolville, Ohio; Paulina Telephone Company, Paulina, Iowa; Louisville Anchorage & Pewee Valley Electric Railroad Company, Louisville, Ky.; Northern Indiana & Southern Michigan Telephone and Telegraph Company, Centerville, Ind.; Fort Wayne Electric Works, Fort Wayne, Ind., and the Inter-Lake Telephone Company, Canandaigua, N. Y.

THE GOULD STORAGE BATTERY COMPANY, New York city, has closed among recent contracts, the following: Philadelphia & Lehigh Valley Traction Company, a battery of 196 cells, and switchboard with a discharge capacity of 200 amperes; Warren Electric Street Railway Company, located at Warren, Pa., 240 cells, 0-509, in glass jars, switchboard and Gould C, E. M. F. regulating booster, discharge capacity 160 amperes; Dayton & Muncie Traction Company, four plants, located at Winchester, Ind., Selma, Ind., Union City, Ohio, and Greenville, Ohio, each battery consisting of 305 cells, type S-609, in lead-lined tanks, type S-611, plate capacity 320 amperes, tank capacity 400 amperes, switchboard and 44-kilowatt regulating Gould C, E. M. F. booster; Odell Illuminating Company, battery located at Odell, Ill., consisting of 124 cells, N-411, in N-413 jars, capacity 240 ampere-hours at 240 volts for three-wire lighting system; Manhattan Heat, Light and Power Company, battery located at St. Paul, Minn., consisting of 56 cells, S-627, in lead-lined tanks, capacity 2,080 ampere-hours, switchboard and automatic Gould C, E. M. F. booster for block lighting and regulation.

FRANK B. COOK, 240-244 West Lake street, Chicago, Ill., manufacturer of protective devices, distributing boards, and cable terminals, has secured a number of orders for a large amount of his goods. Prominent there are cable terminals and protectors for the Kinloch Telephone Company, of St. Louis, pole-top terminals and tubular-line fuses for the Home Telephone Company, of Los Angeles, Cal., terminals and protectors for Home Telephone Company, Springfield, Mo., protectors with main distributing boards from the Automatic Electric Company. The North Electric Company has placed orders for distributing boards and protectors for exchanges at Wooster, Ohio; Eureka Springs, Ark.; Onsonta, N. Y.; Bellefontaine, Ohio, and two or three other points. The Kellogg Switchboard and Supply Company ordered about 9,000 pairs of protectors, some 8,000 of which are for the Home Telephone Company, Los Angeles, Cal. The Stromberg-Carlson Telephone Company has also placed a large order, and in addition to these, many smaller orders have been received requiring a total for all orders of 110,000 heat coils, 240,000 carbon-arrester plates and 61,000 tubular line fuses.